THE
BRITISH JOURNAL OF SURGERY

VOL. XXVIII APRIL, 1941 NO. 112

NASOPHARYNGEAL CARCINOMA

BY K. H. DIGBY, WM. LAI FOOK, AND YEUNG TSAW CHE, HONG KONG

PRIMARY malignant disease of the nasopharynx cannot be a common disease in Great Britain. It receives scant attention in text-books on surgery and rarely appears in British statistics of malignant disease treated by radiotherapy.

In *Diseases of the Nose and Throat* (Sir St. Clair Thomson and V. E. Negus) one reads: "Primary malignant disease of the nasopharynx is rare . . . Sarcoma, endothelioma, blasto-teratoma, and rhabdomyosarcoma" are cited as having been recorded. Carcinoma is only mentioned as "said to be common in Hong Kong, many cases leading to enlargement of glands in the neck" (reference to paper by Digby).

References in the literature descriptive of this disease in England are not numerous. The earliest account appears to be that of Trotter in 1911. Subsequent papers have appeared in 1929 by Gardham, in 1933 by Christianson and McArthur, and in 1938 by Munro Black.

In the United States several excellent accounts of malignant disease of the nasopharynx have appeared—New, 1922; Ewing, 1929; and Furstenberg, 1938—but in none of these is the disease recorded as of frequent occurence.

Further references are given by the above authors, including articles in the French and German literature—but the disease is nowhere recorded as common.

It is therefore with some amazement that one observes the great number of sufferers from this condition in Hong Kong and South China (Oscar Thomson, 1923; Digby, 1930, 1934, 1936; Cheng Yu-Lin, 1935; Dunlap, 1938).

During eight years, in wards of the Hong Kong University Gynæcological Unit, there were 211 cases of malignant disease; in the Surgical Unit there were 419 cases and no less than 114 of these were cases of nasopharyngeal carcinoma (*Tables I, II*):—

Table I.—ANALYSIS OF 211 CASES OF MALIGNANT DISEASE
(University Gynæcological Clinic, Hong Kong, April, 1930, to April, 1938)

Carcinoma of cervix	174
Malignant disease of ovary	22
Carcinoma of body of uterus	5
Carcinoma of vulva and perineum	3
Miscellaneous	7
Total	211

I am indebted to Dr. A. P. Court, recently in charge of the Gynæcological Unit, for these figures.

Table II.—Analysis of 419 Cases of Malignant Disease
(Admitted during the same period in the wards of the Surgical Unit)

Nasopharyngeal carcinoma	114
Breast carcinoma	74
Penis epithelioma	19
Tongue and floor of mouth epithelioma	18
Liver carcinoma	15
Œsophagus epithelioma	12
Rectum carcinoma	9
Thyroid carcinoma	9
Testis malignant growth	7
Stomach carcinoma	7
Scalp epithelioma	6
Retroperitoneal sarcoma	5
Nasopharyngeal myxo-angioma	4
Miscellaneous malignant growths of face	22
Miscellaneous malignant growths of orbit and eyeball	17
Other cases of malignant disease	81
Total	419

Combining these two groups of figures, of 620 cases of malignant disease in the surgical and the gynæcological units :—

174 were carcinoma of the cervix (27·6 per cent)
114 were nasopharyngeal carcinoma (18·0 per cent)
74 were carcinoma of the breast (10·7 per cent)

To sum up, by far the most common types of malignant disease were: carcinoma of the cervix, nearly 28 per cent; carcinoma of the nasopharynx, 18 per cent; carcinoma of the breast, nearly 11 per cent.

Thus in Hong Kong carcinoma of the nasopharynx appears to rank second in frequency in a list of all cases of malignant disease.

DIAGNOSIS

In discussing this unusual clinical condition it is desirable to define exactly the criteria which are relied upon as establishing the diagnosis for the purposes of this paper.

We have endeavoured to write down those features which lead us to think a patient is suffering from nasopharyngeal carcinoma and to assess the value to be attached to each.

A full account of the symptoms, physical signs, and findings appears later, and it will then be seen how numerous these are, and in what a great variety of selections of them the disease may manifest itself. We have therefore attached a numerical value to the principal manifestations of the disease in such a way that if the marks allotted to the signs present in any one case total over 50 we regard the case as probably one of nasopharyngeal carcinoma. Although the earlier cases which form the basis of this paper were not actually so marked, the marking scheme represents roughly the relative diagnostic value of the signs and symptoms which we have accepted throughout.

Criteria of Diagnosis of Nasopharyngeal Carcinoma

If the patient is under 15 years of age, 10 marks should be deducted, thus definitely excluding cases of adenoid enlargement with enlarged cervical glands and ear and nose trouble, the marks of which might nearly reach 50.

If the patient is between 15 and 25 years of age and there is broadening of the root of the nose and separation of the orbits (the so-called ' frog face ') 10 marks should be deducted. This excludes cases of nasopharyngeal fibroma, or perhaps more accurately nasopharyngeal myxo-fibro-angioma.

A characteristic hard tumour seen or felt in the nasopharynx	up to 25
(If a microscopical section shows characteristic nasopharyngeal carcinoma, up to 90)	
(As the condition is best treated by radiotherapy, and as removal of a piece for section may unfavourably influence the condition, whereas a gland in the neck can usually be removed easily under local anæsthesia, this pathognomonic test has not often been made in our series)	
Characteristically enlarged cervical glands, i.e., bilateral, but asymmetrical and asynchronous	up to 25
If with section showing characteristic small-celled carcinoma add	up to 15
Characteristic nose signs	up to 15
Characteristic ear signs	up to 5
Characteristic cranial nerve paralysis	up to 5
Characteristic headache (unilateral at commencement)	up to 5
Characteristic proptosis or tumour in temple or face	up to 5
	Total 100

AETIOLOGY

With regard to aetiology, the early age of onset in many cases is a noteworthy feature. Cancer usually sets in after 40, but this form of cancer commences as often before 40 as after (125 cases below 40, 85 cases after 40, in our series).

Fig. 306 shows the age incidence in quinquennial periods in 210 Chinese cases. It will be seen that the two quinquennial periods 31–35 and 36–40 are those in which the greatest numbers of cases occur. The female cases are represented by shaded oblongs in our diagram. It is clear that the disease is less common in females than in males (50 females and 160 males in our series, i.e., 1 to 3·2). It also tends to occur somewhat earlier in women, the ' peak ' period being 31–35 as against 36–40 in the male.

It will be noticed that the disease occurs not very infrequently in young adults and even in older children.

Although the 210 cases recorded are Chinese, we have seen during the same period a certain number of Filipino and Indian patients with nasopharyngeal carcinoma—but no Europeans. The disease, moreover, is not only confined to the Cantonese, but occurs in Amoy (Dr. J. H. Montgomery), in Swatow (whence many cases come to us), in Foo Chow, and in Peiping.

It is natural to seek for some predisposing factor to account for the frequency of the disease in Hong Kong and the surrounding country.

We will not repeat some of the fantastically absurd theories that have been put forward. The only hypothesis of value is that of Dobson, of Yeung Kong, who suggests that the soot-laden atmosphere in small dwellings irritates the nasopharyngeal lymphoid tissue and predisposes to nasopharyngeal malignant disease. " Native houses in this region are not ventilated. A small hole in the roof or a window a foot square are about the only openings except the door, which is generally closed. The fireplace has no flue and is fed with dry grass or a poor quality of wood. Tobacco smoke is universally present, while guttering candles light the ancestral table and incense adds its quota. It is rare that one sees a kerosene lamp that does not smoke; open kerosene or clay lamps burning pea-nut oil are very general among the poor."

If this hypothesis be true, we should expect a greater frequency in the women who spend more time indoors than do the men, yet the reverse is the case. In the country districts, however, the women are out in the open air almost as much as the men.

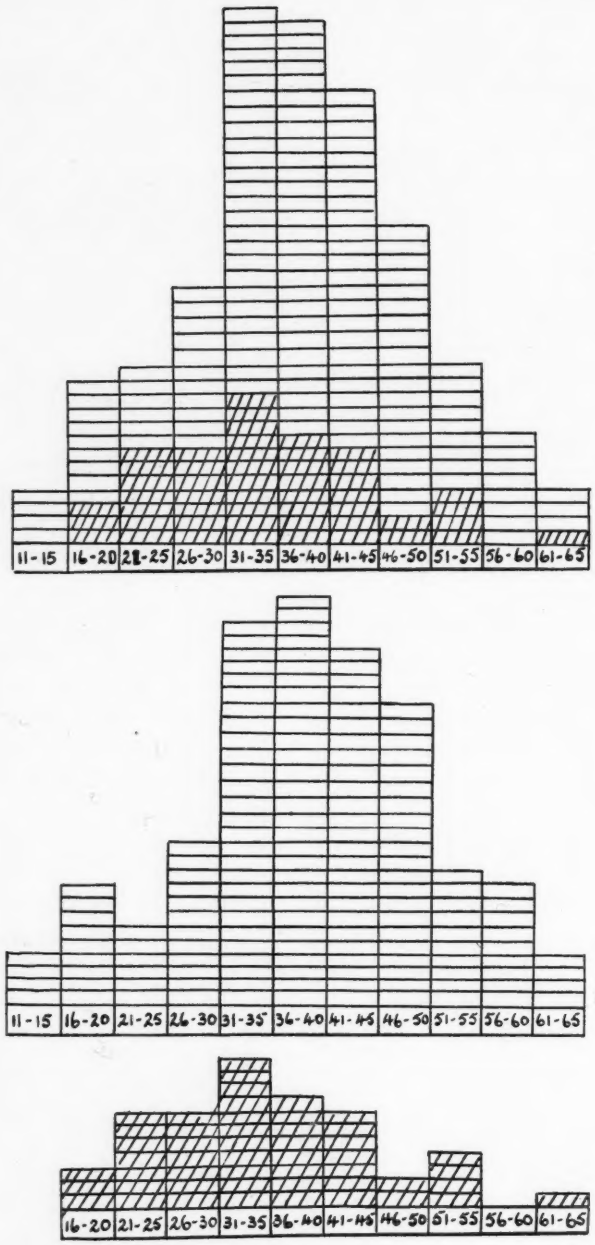


FIG. 306.—Age incidence of nasopharyngeal carcinoma in quinquennial periods in 210 Chinese cases. Each shaded rectangle represents a female patient, each clear rectangle represents a male patient. Above, the figures for the two sexes are combined.
Below, the male and female cases are separated, showing the somewhat earlier age incidence in females than in males.

SYMPTOMS AND SIGNS

The disease is characterized by an exceptionally lengthy list of symptoms and signs, for (beginning near the centre of the head) the ear, nose, and orbit, and upper cervical region may be soon reached; and the functions of every one of the cranial nerves and of the cervical sympathetic chain may be affected in different cases.

Nevertheless sufferers from this disease tend to fall into certain groups :—

1. The commonest of these shows enlargement of the upper deep cervical glands on both sides: but those on one side have appeared earlier and are larger than on the other side. Enlargement may be confined to one side. In 42 out of 65 cases, enlarged cervical glands were the earliest symptoms noticed by the patient.

These cases are often wrongly regarded as syphilitic and we have seen such cases treated for long periods on anti-syphilitic lines. Other cases are treated as tuberculous with sunshine, cod-liver oil, etc. We remember a Chinese dresser in the Civil Hospital being so treated for many months until the mass of glands was removed and sections cut, when carcinoma was demonstrated. The poor fellow eventually died, possibly from an overdose of opium taken to end his sufferings.

Of course syphilis occasionally coexists with nasopharyngeal carcinoma, so that a positive Wassermann or a positive Kahn reaction is obtained.

The association with tuberculous infection is more common, and several cases have shown in the same microscopical field both cancer cells and typical giant cells of tuberculous origin.

2. The case may present itself as one of nasal obstruction, unilateral to begin with, but eventually becoming bilateral. Nasal obstruction was the first complaint in 4 out of 65 cases. But it occurs in 59 per cent of the later cases. A runner of growth may creep forward towards the nostril and simulate a simple polypus. The redness, opacity, and severity of the hæmorrhage upon attempted removal should put the surgeon on his guard, and the good rule that all growths removed from the nose should be sectioned ought to prevent this mistake being made. We have, however, seen several cases of such error.

3. The cardinal symptom may be epistaxis. This was the first sign in 9 cases out of 65 cases. This may be recurrent. In one man epistaxis occurred on and off for two years before any other symptom appeared and continued spasmodically till the patient died 5 years after the first bleeding.

4. The earliest symptom may be headache (noted in 4 out of 65 cases). This has raised the suspicion of intracranial tumour. In later cases more than one-third of the sufferers have severe headache.

5. The patient may present himself with exophthalmos. This was the earliest symptom in 1 out of 65 cases, but it occurred later in 2 other cases of that series.

6. Rarely, the patient may first seek advice for ear symptoms: pain in the ear, tinnitus, or deafness. These are common later in the disease (46 out of 65 cases, i.e., 71 per cent).

7. Paralysis of one of the cranial nerves may appear to the physician to be the main sign when the patient comes to hospital.

8. In one case at least the early pain was neuralgic and led to the extraction of numerous teeth before the real nature of the condition was realized.

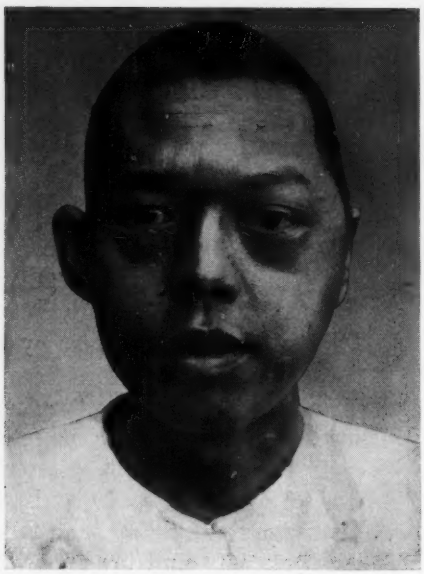


FIG. 307.—Fullness of left temple in a case of nasopharyngeal carcinoma.

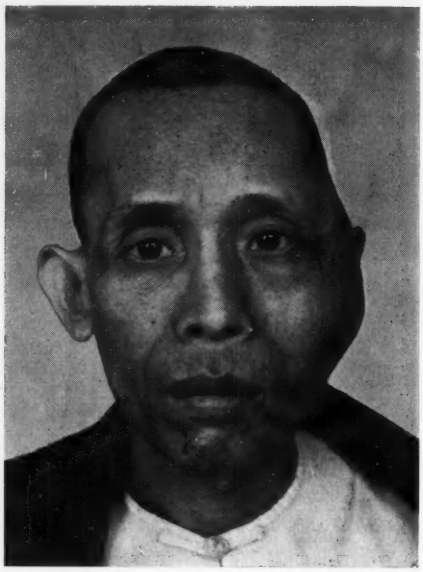


FIG. 308.—Fullness of left cheek in a case of nasopharyngeal carcinoma.

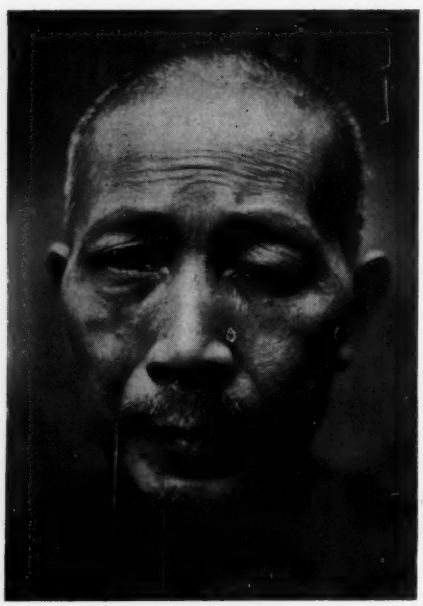


FIG. 309.—Wasting of left temporal region from trigeminal paralysis in a case of nasopharyngeal carcinoma (left ptosis due to oculomotor paralysis is also seen).

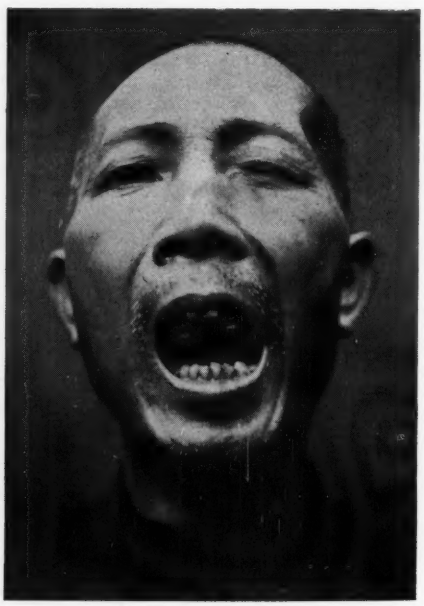


FIG. 310.—Same case as in *Fig.* 309. Wasting of left cheek due to paralysis of masseter muscle. The mandible had deviated to the left side on opening the mouth. (Wasting of the temple and ptosis are also shown.)

One may now proceed to enumerate a full list of the symptoms and signs which have been observed in this disease and which should be looked for as a routine practice.

In making a routine examination of a case suspected to be one of carcinoma of the nasopharynx, one first looks at the face, scalp, and eye. Fullness of one temporal region (*Fig.* 307) or fullness of the posterior part of the cheek may be seen in the late cases (*Fig.* 308). There may be wasting of the temple (*Fig.* 309) or the cheek (*Fig.* 310) due to paralysis of the temporal or of the masseter muscles. Or there may be fullness of the orbit with proptosis of the eyeball (*Fig.* 311). Indeed, in our clinic, the commonest cause of unilateral exophthalmos is nasopharyngeal carcinoma. There may be an extensive tumour in the orbit (*Fig.* 312).

In one late case three lumps were visible on the cranium, being metastatic deposits in the cranial bones. Hemicranial headache is frequent and may be frontal, temporal, or occipital, or all three, in its distribution.

On examining the eyeball it may be found that there is complete blindness on one side with corresponding absence of pupil reflex to light. This usually signifies that the growth has spread to the orbit and involved the optic nerve. Examination of the disc should show optic atrophy, though this has not always been recorded in our series. One case showed slight papillœdema.

Or one may find a medial squint in one eye (*Fig.* 313), signifying paralysis of the abducens nerve. This is fairly frequent, for the abducens nerve seems specially vulnerable in this disease, as indeed appears to be the case in other diseases also. One patient with undoubted nasopharyngeal carcinoma presented bilateral medial squint (*Fig.* 314).

Sometimes oculomotor nerve paralysis is indicated by ptosis (*Fig.* 315), lateral squint, and dilated pupil. The paralysis may be partial, e.g., ptosis alone may occur. The trochlear nerve may be paralysed, producing diplopia on looking inferolaterally. We have not seen this nerve affected by itself without other motor nerves to the eyeball being concerned. Complete motor paralysis has been noted.

When the trigeminal nerve is paralysed, anæsthesia may be found by testing the sense of touch to cotton-wool on forehead, cheek, and side of chin. There may be facial neuralgia (*Fig.* 316). Sometimes the motor fibres are affected so that on palpating the masseter muscles one feels that one of them fails to harden on clenching the teeth. The jaw is then deviated to the paralysed side (*see Fig.* 310). One patient complained of a spasmodic tingling over the distribution of the maxillary division of the trigeminal nerve when hungry, which was relieved by food.

Affection of the cervical sympathetic trunk is seen with some frequency. It is indicated by narrowing of the palpebral fissure, enophthalmos, and small pupil on one side (*Fig.* 317). On inquiry, sweating over one side of the head and neck may be affected—sometimes lessened and sometimes increased, the latter especially on taking food. Profuse perspiration on one side of the nose during eating was observed in one patient.

In one case of a woman who was very miserable and often wept, it was noticed that the tears only flowed from one eye, the secretion of the opposite lacrimal gland apparently no longer being affected by emotional stimulus. Perhaps, however, this was due to involvement of fibres of the facial in the trigeminal nerve.

FIG. 311.—Proptosis of right eyeball due to spread of nasopharyngeal carcinoma to the orbit.

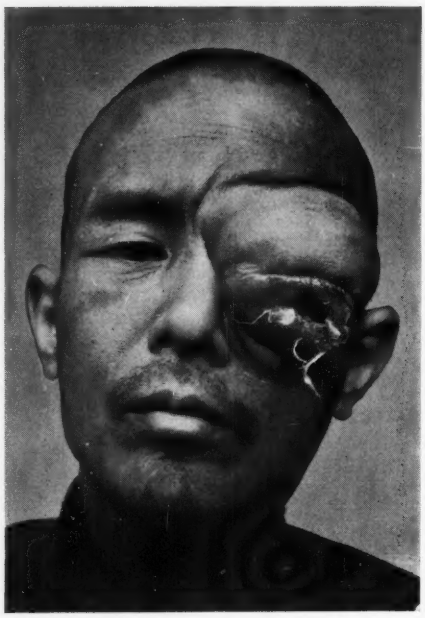


FIG. 312.—Large tumour of left orbit from spread of nasopharyngeal carcinoma.

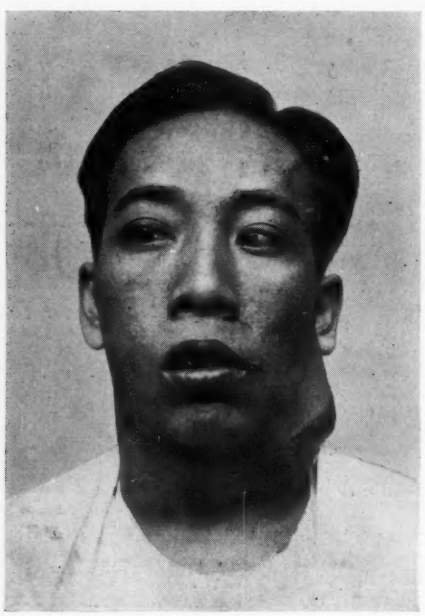


FIG. 313.—Abducens paralysis of left eyeball producing a medial squint in a patient with nasopharyngeal carcinoma.

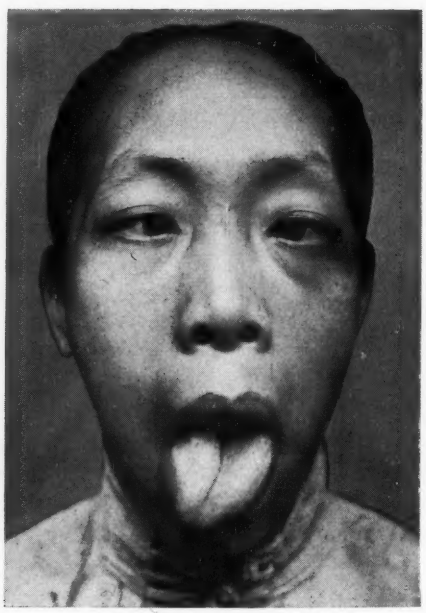


FIG. 314.—Bilateral medial squint in a case of nasopharyngeal carcinoma.

The facial nerve is paralysed at times in these cases, and this can easily be seen by inability of the patient to close completely the palpebral fissure on the affected side, or by deviation of the angle of the mouth to the sound side on whistling or smiling (*Fig.* 318).

The mouth, throat, and larynx should be considered next in order.

In some late cases breathing through the oropharynx may be obstructed. This may require the performance of an emergency tracheotomy on admission to hospital.

The patient should be asked to open the mouth and the distance between the biting edges of upper and lower central incisors measured at the maximum gape.

The tongue is then depressed with a spatula and the soft palate studied. A large nasopharyngeal tumour will produce marked depression of the soft palate, chiefly on one side. In earlier cases the uvula will show slight asymmetry, being displaced to one side (*Fig.* 319). Or it may be at rest in the middle line and only deviate to one side when the patient says 'ah'. Unilateral or bilateral paralysis of the movements of the soft palate has been noticed, and also insensitivity to probe tip or to taste of salt or quinine. An advanced case with the growth spreading forward into the nose may show a mass on the under surface of the hard palate on one side.

The new growth in the nasopharynx when it is large will form a tumour projecting below the uvula and the lower edge of the curtain-like soft palate; or even growing down in the posterior wall of the oropharynx. When not so large it can only be seen by means of a post-nasal mirror or a nasopharyngoscope. It may, however, be palpable with the finger feeling through the soft palate or by the finger introduced behind the soft palate, though the latter method is liable to provoke considerable hæmorrhage. The primary growth is sometimes so small as to defy detection in the early stages. It may be a tiny crack or minute area of induration in the fossa of Rosenmüller, though the glandular enlargement may be very considerable.

The tongue is then examined; when, as frequently occurs, one hypoglossal nerve is infiltrated, the tip of the tongue is protruded to the same side when the patient is asked to put out the tongue (*Fig.* 320). Moreover he cannot protrude his tongue to the opposite side when requested to do so. Tremor and wasting of the affected half of the tongue are also seen.

Paralysis of the glossopharyngeal nerve is shown by insensibility to touch with a bent probe to the posterior one-third of the side of the tongue, and less easily by loss of taste of salt or quinine carefully applied to the same area after drying. Paralysis of the glossopharyngeal nerve has not been observed by us without accompanying anæsthesia of the anterior two-thirds of the tongue, which latter may be due to involvement of the chorda tympani or of the mandibular division of the trigeminal nerve at the base of the skull.

If the patient has a hoarse voice and a brassy cough, laryngoscopic examination may reveal abductor or complete paralysis of one vocal cord. Abductor paralysis has been seen in several of our cases.

Attention is next directed to the nose. The breathing is frequently obstructed on the side most affected. In late cases both sides may be blocked. The speech is then affected, all nasal tones being suppressed; M and N become B and D, thus 'bad man' becomes 'bad bad'. In one case with paralysis of the soft palate, but without nasal obstruction, the converse was observed. As the nasopharynx could

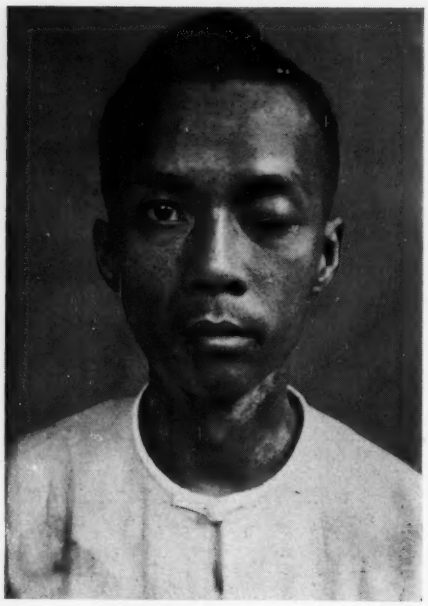


FIG. 315.—Left-sided ptosis due to involvement of the oculomotor nerve in a man with nasopharyngeal carcinoma.

FIG. 316.—Involvement of sensory fibres of the trigeminal nerve in a woman with nasopharyngeal carcinoma. The area marked by crosses represents the site of severe neuralgia; the area marked by oblique lines indicates the extent of tactile anæsthesia.

FIG. 317.—Narrowed right palpebral fissure and enophthalmos due to involvement of the cervical sympathetic by nasopharyngeal carcinoma.

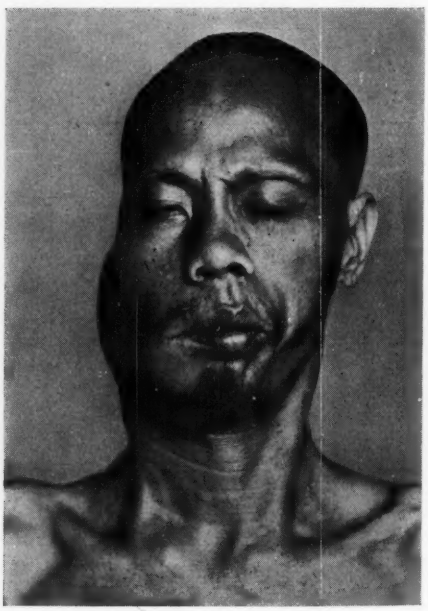


FIG. 318.—Facial paralysis on the right side in a case of nasopharyngeal carcinoma.

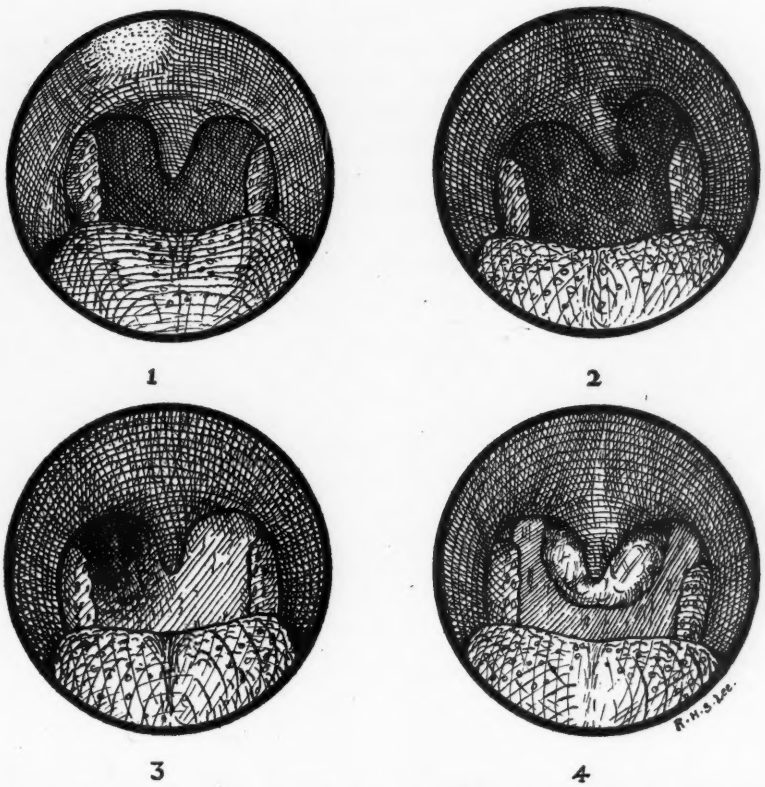


FIG. 319.—Diagram of appearances of the fauces in different cases of nasopharyngeal carcinoma: 1, Slight bulging depression of soft palate on one side; 2, Deviation of soft palate to opposite side when patient says 'ah'; 3, Growth creeping down behind soft palate on one side; 4, Tumour projecting below the uvula.

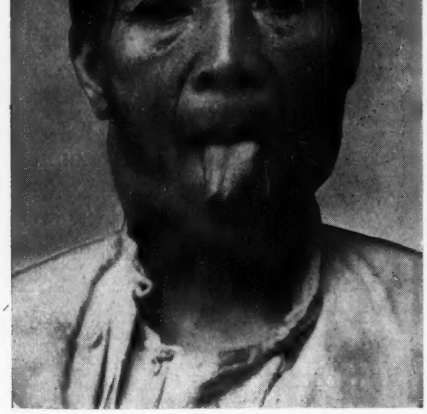


FIG. 320.—Paralysis of the right hypoglossal nerve in a woman with nasopharyngeal carcinoma. The sympathetic chain is also paralysed, showing enophthalmos and narrowed palpebral aperture on the same side.

FIG. 321.—Nasal polypus from nasopharyngeal carcinoma.

not be shut from the oropharynx, B and D became HM and N, thus ' bad man ' became ' hman man '.

Discharge of blood from the nose is a complaint in a great many cases. The loss is usually considerable, but at long intervals. There may be discharge of excess of mucus from one or both nostrils. A disagreeable odour may be noticed in the patient's expired breath.

There may be loss of sense of smell on one or both sides as tested by iodoform or by tinct. benzoin. co. This has been due in our cases to the obstruction. We have not observed a case where there was clinical reason to suspect pressure on the olfactory tract.

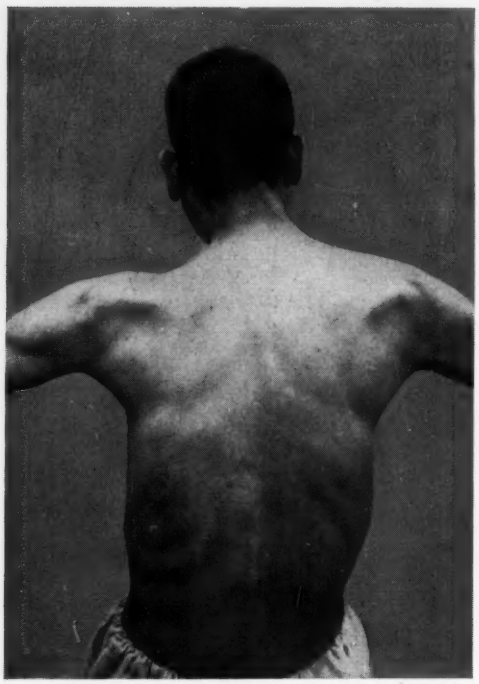


FIG. 322.—Wasting of upper border of left trapezius in a case of nasopharyngeal carcinoma.

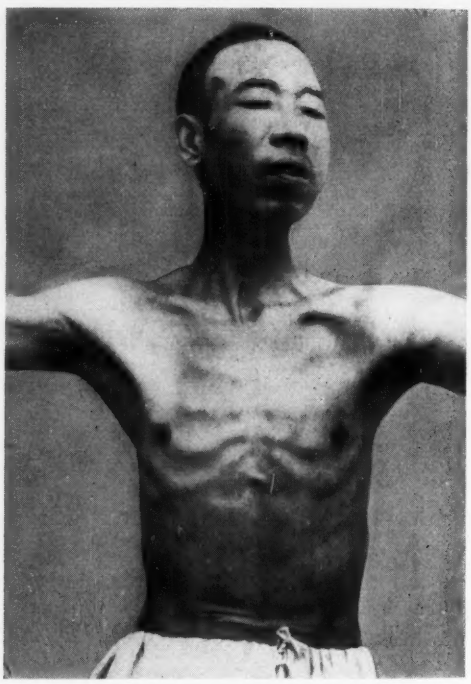


FIG. 323.—Wasting of left sternomastoid and trapezius.

With a nasal speculum a polypus or runner of growth may be seen in the blocked side or it may even protrude through the anterior naris (*Fig.* 321).

The ear should then be observed. There may be otorrhœa—a thinnish discharge from the ear on the more affected side. There may be a history of slight tinnitus. Deafness of moderate degree and of middle-ear type is commonly observed. The membrana tympani may show retraction or perforation on one side. In one case acoustic nerve deafness was observed.

Examination is next directed to the neck. When the patient is asked to turn his head round from one side to the other it may be seen that the rotation is limited in one direction. In advanced cases rotation to both sides may be interfered with.

Effects of paralysis of the accessory nerve have been seen in the neck in many cases. This is indicated by inability to shrug the shoulders, wasting of the upper

border of the trapezius (*Fig.* 322), and failure of the sternomastoid to stand out in relief when the patient looks upwards and to the opposite side (*Fig.* 323).

The chief sign in the neck, however, is enlargement of the cervical glands (*Figs.* 324–328). This may be slight, moderate, or enormous. It is nearly always

FIG. 324.—Enlarged cervical glands in a case of nasopharyngeal carcinoma.

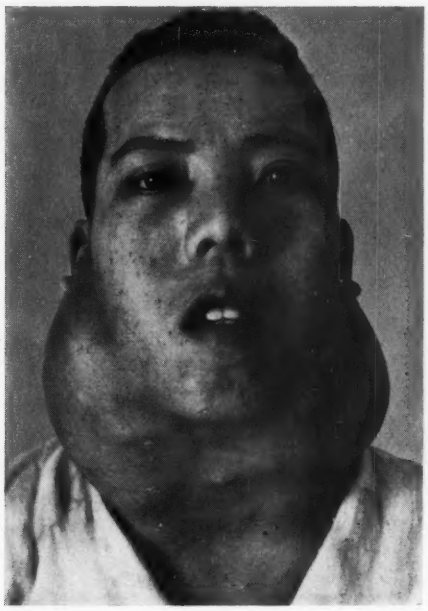
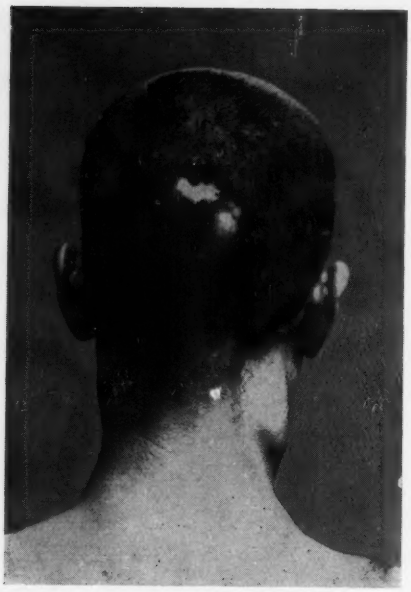
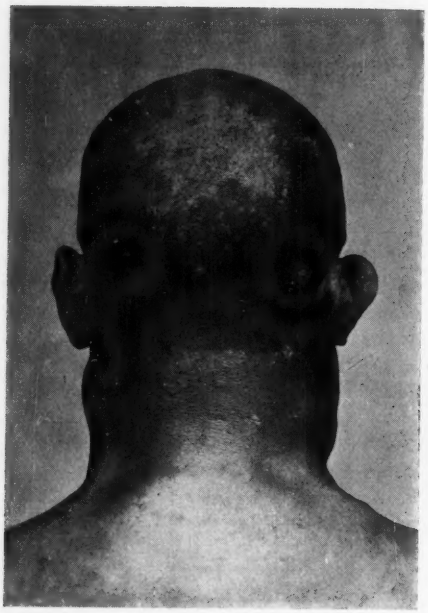


FIG. 325.—Great enlargement of glands in the neck in a case of nasopharyngeal carcinoma.

FIG. 326.—Great enlargement of glands in the neck in a case of nasopharyngeal carcinoma.





FIGS. 327, 328.—Enlarged cervical glands in nasopharyngeal carcinoma, seen from behind.

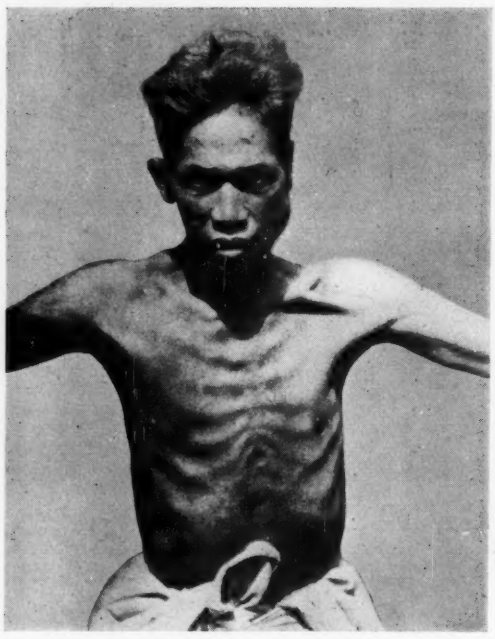


FIG. 329.—Wasting of the sternal part of the pectoralis major in a case of nasopharyngeal carcinoma.

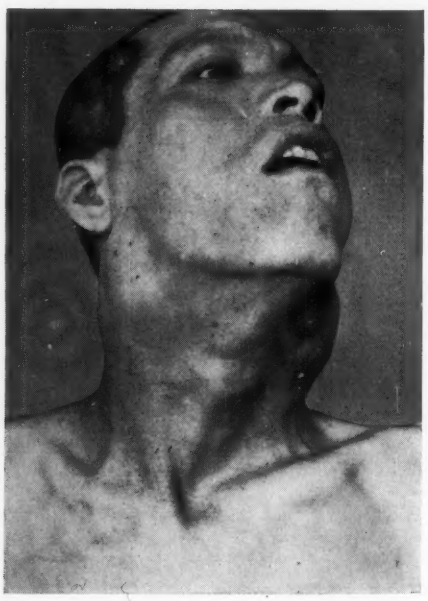


FIG. 330.—Wasting of left infrahyoid muscles as well as left sternomastoid muscle in a case of nasopharyngeal carcinoma.

more advanced on one side than it is on the other, that is to say the enlargement is *asymmetrical and asynchronous*. This is a point of much diagnostic value. The glands first enlarged are those of the upper deep cervical chain beneath the anterior border of the sternomastoid. As the disease spreads, the glands in the posterior triangle are affected principally. It cannot be emphasized too strongly that involvement of the cervical glands does not always take place early, so that for a very long time in such cases there may be no lumps in the neck.

With regard to effects of the disease elsewhere, we may call attention to the fact that the spread along the lymphatic glands may reach the axilla, so that enlarged axillary glands should be searched for.

FIG. 331.—Secondary growth on the left shoulder in a case of carcinoma of the nasopharynx.

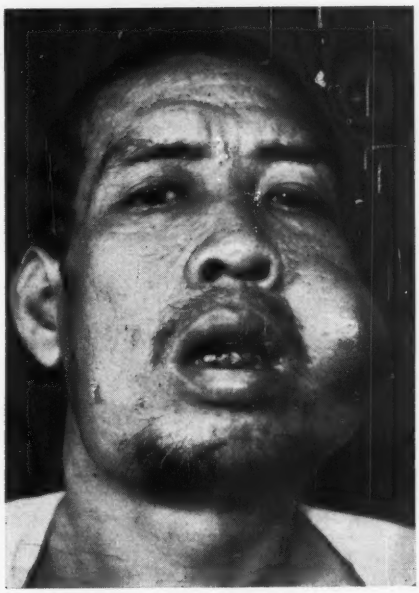


FIG. 332.—Secondary deposit in the cheek in a case of nasopharyngeal carcinoma.

Involvement of the brachial plexus has been seen in wasting of the sternal part of the pectoralis major (*Fig.* 329).

Paralysis of the descendens hypoglossi has been shown in one or two cases, as shown by the inability of the sternohyoid and other infrahyoid muscles to stand out in relief when the head is thrown back and the patient looks to the opposite side (*Fig.* 330).

Nodules of growth have also been seen attached to the deep fascia on the front of the chest and on the back of the shoulder (*Fig.* 331), and in the cheek (*Fig.* 332). The spread here appears to be one of ' permeation ' of the deep lymphatics, similar to that described by Sampson Handley for carcinoma of the breast. Secondary deposits have also been seen in the pelvis (*Fig.* 333).

Of other metastatic deposits, pain in the back has suggested growths in the spinal column, and in one case this was shown by X rays (*Fig.* 334), and one deposit has been found post mortem in the spinal theca (*Fig.* 339), and gross and rapid enlargement of the liver has been observed in several cases and proved at

post-mortem examination (*Figs.* 335, 340) to be due to secondary deposits of nasopharyngeal carcinoma. When the liver is thus involved, pyrexia has been a prominent symptom, as has also œdema of the legs. Autopsy has demonstrated

FIG. 333.—Radiograph of a secondary deposit in the pubis in a case of nasopharyngeal carcinoma.

metastasis in the lung (*Fig.* 341). Multiple deposits of growth in the dura mater of the anterior and middle cranial fossæ are seen at some of the autopsies. Giddiness, loss of appetite, loss of weight, weakness, and anæmia are seen in late cases. The Hb percentage in a number of our cases was down to 70. The white count was usually normal, though occasionally raised to 18,000 per c.mm.

X-ray examination gives useful information in various ways. A lateral view

FIG. 334.—Radiograph of a secondary deposit in the spine in a case of nasopharyngeal carcinoma.

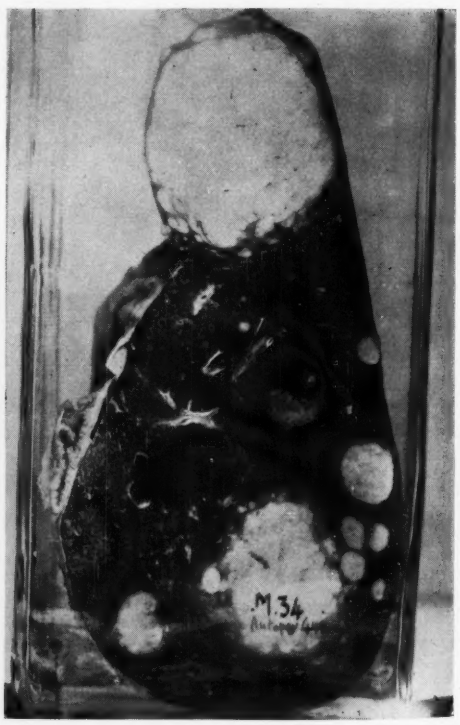


FIG. 335.—Secondary deposits in the liver from a patient who had died of nasopharyngeal carcinoma.

of the skull may be taken to show irregularity of the nasopharyngeal clear space, and in late cases even erosion of the base of the skull may be detected. An

anteroposterior view may show unilateral opacity of the maxillary sinus, ethmoidal, sphenoidal, or frontal air spaces. Secondary deposits in the calvarium or in the spine (*Fig.* 334) or pelvis (*Fig.* 333) may be looked for by radiological examination.

The duration of the disease is variable. The victim may live from three months to five years or more from the first sign of the disease. The disease may thus be long drawn out, even apart from radiotherapy.

PATHOLOGY

We wish to express our indebtedness to the Pathology Department of the Hong Kong University for ungrudging help and advice; to the late Professor C. Y. Wang and to Professor L. J. Davis, who have been in charge of the Department, and to Dr. K. T. Loke of the Department; and to Dr. Ling Ke Dien for help with the microscopical photographs.

With regard to pathology, the first question is what is the nature of the normal growth? All the cases here reported have not been sectioned. In most instances where the growth has been microscopically examined, the sections have been taken from secondary deposits in the cervical glands. The primary growth has, however, occasionally been cut.

We do not know for certain the precise starting point, but the nasopharyngeal growth has appeared to arise in the lateral wall behind the tuba auditiva or in the posterior wall, or in the roof. A few of the cases here recorded might have been carcinoma of one of the nasal fossæ spreading backwards, but the early presence of glands on *both* sides of the neck rendered this unlikely.

The nasopharynx is lined in its upper part by columnar epithelium—in its lower part by stratified epithelium. Mucous glands and lymphoid tissue also occur. New growths might arise from any of these. Malignant new growths arising from columnar epithelium lining tubular glands reproduce the original spaces. No such spaces are seen in our nasopharyngeal carcinomata. But possibly carcinomata derived from columnar cells forming a carpet over a surface do not tend to form such spaces. In the sections of secondary glands and primary growths, the malignant cells are sometimes small columnar, sometimes small spheroidal, and sometimes distended to form large cells staining lightly. It is, however, conceivable that the carcinoma is derived from the mucous glands. Our present view is that the carcinoma is derived from the columnar epithelium lining the upper part of the nasopharynx.

One section showed beautifully the origin of the primary growth as arising from columnar epithelium at the junction where normal stratified epithelium meets normal columnar epithelium (*Fig.* 336). The cancer cells of the primary growth tend to ramify in the surrounding tissues in closely packed columns or plaques (*Fig.* 337), the cells being mostly spheroidal in shape, staining more deeply than normal tissue, their nuclei being of moderate size, mitosis being frequently present. The cells at the periphery of these columns appear as a single row of columnar cells in many cases. The rapid spread of the growth leads to starvation of the central portions, with the result that central areas of necrosis are frequently present. The stroma is moderate in amount and contains a fair number of lymphocytes and other round cells. Some blood-vessels are present.

Sections of metastatic glands also show infiltration by similar cells into the gland, such infiltration also occurring in columns or plaques, with occasionally a

few stray carcinoma cells lying outside such columns (*Fig.* 338). In some sections practically the whole gland is replaced by such carcinoma cells. At times a diffuse and homogeneous spread of carcinoma cells over the entire field gives a false suggestion of sarcoma or lymphadenoma. It may be of interest to note that nasopharyngeal malignant growths have been assigned by different authors to the categories of epithelioma, transitional-cell carcinoma, lympho-epithelioma, lympho-sarcoma, and endothelioma in the literature. Typical squamous epithelioma, as recorded by several observers, rarely occurs in this situation, and we have so far only seen one case. We had also a case of myxochondrosarcoma and one or two cases of lymphosarcoma. The so-called nasopharyngeal fibroma, a slow-growing low-grade form of malignant growth causing a frog-face appearance, is

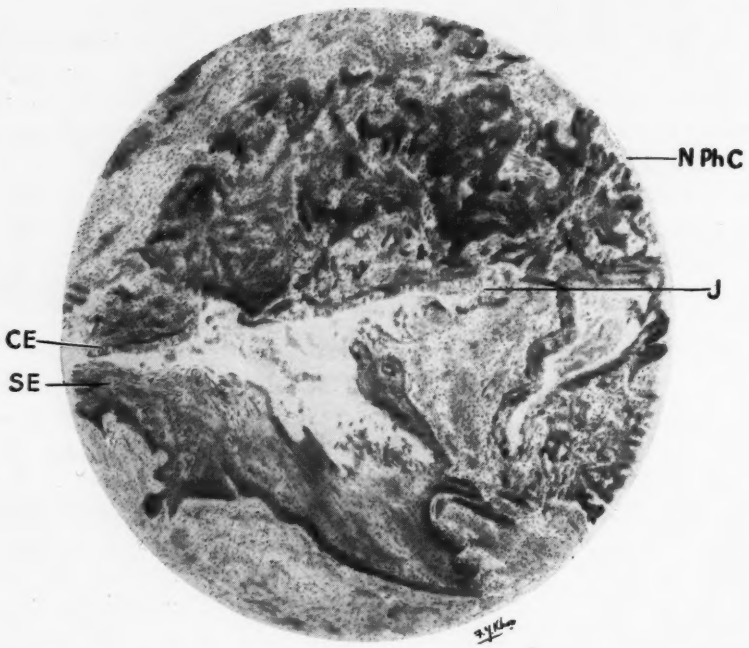


FIG. 336.—Section from primary growth of nasopharyngeal carcinoma arising from columnar epithelium at its junction with stratified epithelium. C E, Columnar epithelium; S E, Stratified epithelium; J, Junction of stratified and columnar epithelium; N Ph C, Nasopharyngeal carcinoma. (*We are indebted to Dr. Fun Yong Khoo for the painting of this slide.*)

not so rare in Hong Kong, as we have already met half a dozen cases. These tend to occur in young males and are large hæmorrhagic tumours causing a marked depression of the soft palate and also tending to protrude outside the nostril.

In three of our cases carcinoma was seen alongside a tuberculous giant-cell system in the same gland. But this is not surprising in view of the appallingly widespread prevalence of tuberculous disease in Hong Kong.

The term lympho-epithelioma should be applied only where the secondary deposits in tissues other than lymph-glands show lymphoid as well as epithelial structure. This condition we have not found. (*Figs.* 339, 340, 341.)

It is interesting to speculate on the method of its spreading. At first, by embolism and probably permeation of lymphatic vessels, it reaches the upper deep

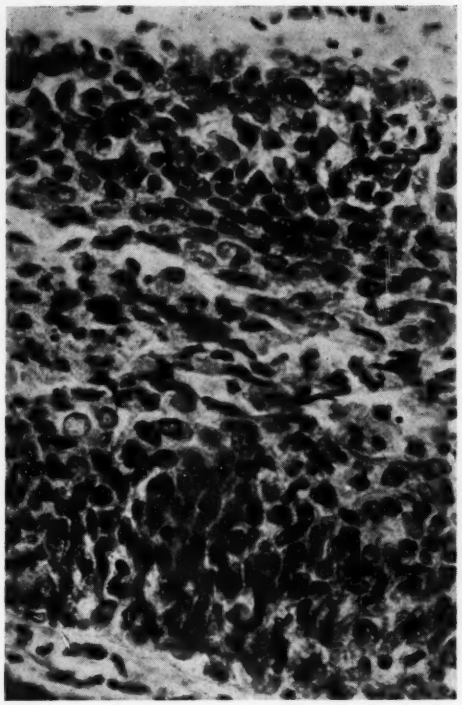


FIG. 337.—Primary growth (high-power view).

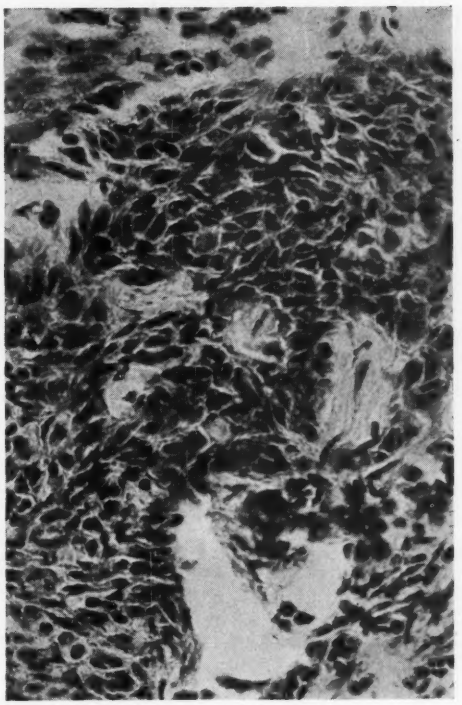


FIG. 338.—Secondary deposits in cervical glands (high-power view).

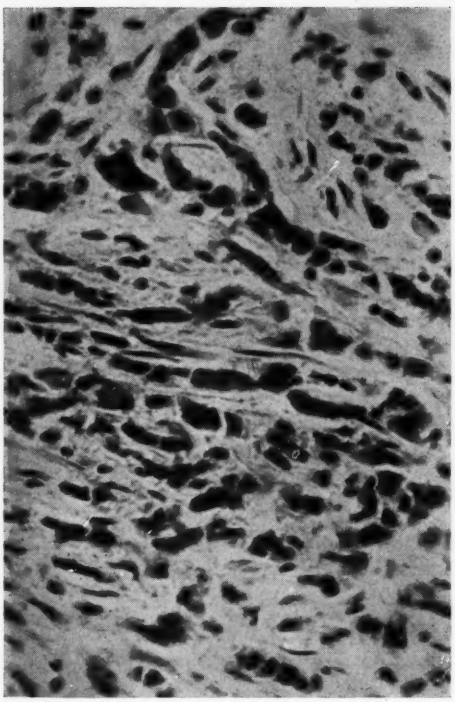


FIG. 339.—Secondary deposits in the spinal theca (high-power view).

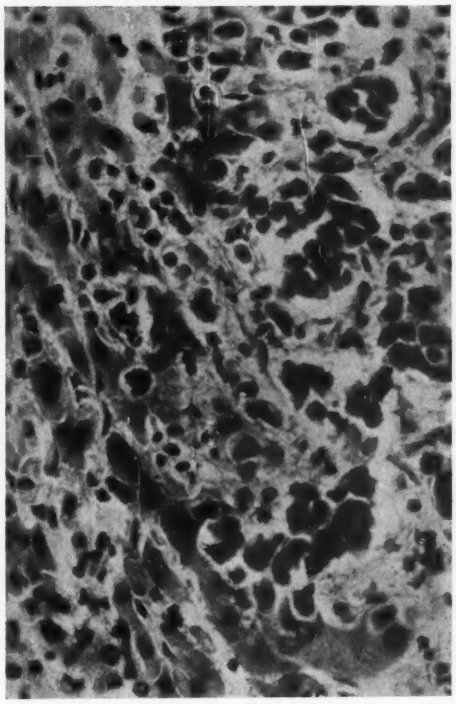


FIG. 340.—Secondary deposits in the liver (high-power view).

cervical lymph-glands and then spreads in a downward and backward direction, the glands in the posterior triangle being widely affected as the case progresses.

As the pharynx is a midline structure and the lymphatic vessels of the two sides anastomose freely on the posterior wall, the glands on both sides are commonly affected, though not to the same degree nor equally soon.

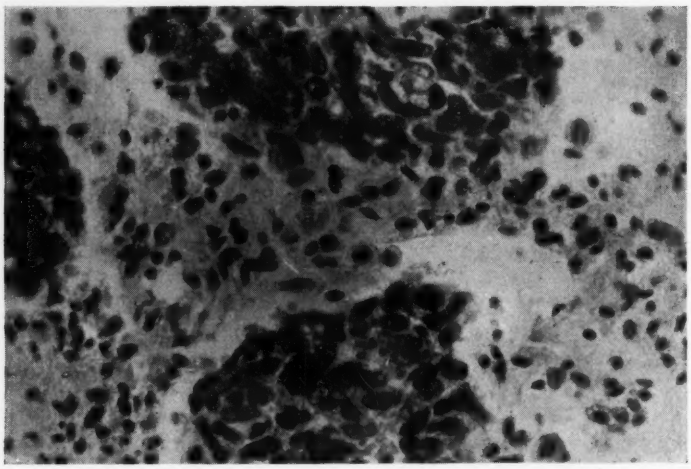


FIG. 341.—Secondary deposit in the lung (high-power view).

Direct spread of the growth upwards into the cranium may take place through most of the foramina in the base of the skull. It may spread laterally into the deep pterygoid region of the infratemporal fossa and then upwards into the temporal fossa, or forwards into the pterygo-palatine fossa, and through this, or directly, into the orbit.

Metastasis also occurs by the blood-stream to the liver (*Figs.* 335, 340), lungs (*Fig.* 341), spinal theca (*Fig.* 339), and bones (*Figs.* 333, 334).

TREATMENT

Our experience of the treatment of these cases has been depressing.

Owing to the early spread of the growth to the region lateral to the naso-pharynx containing the external and internal carotid arteries, the glossopharyngeal, vagus, accessory and hypoglossal nerves, extirpation with the knife is hardly possible. Many years ago one of us would perform block dissections on both sides of the neck with ligature of at least one common carotid and one external carotid artery. This was followed by excision of the upper jaw, or more often, by splitting of the soft palate and cauterization of the primary focus. The patients stood the extensive operations fairly well, but recurrence was almost immediate. Later the primary growth was treated by diathermy after splitting the soft palate. The results, however, were equally bad as to recurrence, and a few cases of secondary hæmorrhage occurred. If it were possible to have these cases for treatment very early, diathermy might be of some use.

Radium treatment has also been tried. Two No. 8 rubber catheters were passed through the nose and out of the mouth, each containing two 6-mg. needles

arranged to rest above the soft palate for 4 to 6 days; together with twenty-five 1-mg. needles on Columbia paste, each needle (2 cm. long with radium 1 cm. in the middle), ends touching, sides 1 cm. apart, at a distance of 1 cm. from the skin, for 10 to 14 days.

The primary and the secondary glands under this treatment rapidly diminish and often disappear, but recurrence follows within six months. Moreover, both general and skin reactions are severe and necrosis of the hard and soft palates and septum may develop. Only one case is known to be alive and free from recurrence seven years after treatment, and no microscopical section had been taken in this case.

Deep X rays hold better prospects of successful treatment, for by using several portals of entry a sufficient dose can be delivered to the lateral relations of the nasopharynx. A sufficient time has not elapsed to evaluate our results of deep X-ray therapy, but at least one case has proved entirely refractory to deep X rays, though of 82 cases treated by radium some improvement was recorded in all.

No radium bomb has been available for trial.

REFERENCES

BLACK, J. I. MUNRO, "The Clinical Manifestation of Malignant Tumours in the Nasopharynx", *Newcastle Med. Jour.*, 1938, **18**, July; "The Lympho-epitheliomata", *Jour. Laryngol. and Otol.*, 1938, **53**, 225.

CHENG YU-LIN, "Lymphoepithelioma of the Nasopharynx with Involvement of the Nervous System", *Chinese Med. Jour.*, 1935, **49**, Oct.

CHRISTIANSON, OSCAR, and MCARTHUR, S. W., "Nasopharyngeal Carcinoma", *Arch. of Surg.*, 1933, **27**, 1109.

DIGBY, K. H., THOMAS, G. H., and HSIU, S. T., "Notes of Carcinoma of Nasopharynx", *Caduceus*, 1930, **9**, No. 2, May.

DIGBY, K. H., "Nasopharyngeal Carcinoma without Clinical Enlargement of Lymphatic Glands in the Neck", *Ibid.*, 1930, **9**, No. 4, Nov.; "Two Further Cases of Nasopharyngeal Carcinoma showing Signs not Previously Recorded in the Surgical Unit", *Ibid.*, 1936, **15**, No. 1, Feb.

DIGBY, K. H., and KHOO, F. Y., "Nasopharyngeal Carcinoma", *Trans. Far Eastern Assoc., Nanking*, 1934, **2**, 903.

DOBSON, *China Med. Jour.*, 1924, **38**, 786 (correspondence).

DUNLAP, A. M., "Malignancy of the Nasopharynx and Eustachian Tube", *Chinese Med. Jour.*, 1938, **53**, 68.

EWING, JAMES, "Lympho-epithelioma", *Amer. Jour. Pathol.*, 1929, **5**, No. 2, March.

FURSTENBERG, A. C., "Malignant Neoplasms of the Nasopharynx", *Surg. Gynecol. and Obst.*, 1938, **66**, Feb.

GARDHAM, A. J., "Endothelioma of the Nasopharynx", *Brit. Jour. Surg.*, 1929, **17**, 241.

NEW, GEORGE B., "Nasopharyngeal Growths", *Jour. Amer. Med. Assoc.*, 1922, **79**, No. 1, 10.

THOMSON, J. OSCAR, "Cervical Lympho-sarcomas, with an Analysis of Ninety Cases", *China Med. Jour.*, 1923, **37**, 1001.

THOMSON, ST. CLAIR, and NEGUS, V. E., *Diseases of the Nose and Throat*, 4th ed., 1937, 355.

TROTTER, W., "Certain Clinically Obscure Malignant Tumours of the Nasopharyngeal Wall", *Brit. Med. Jour.*, 1911, **11**, 1057.

INTRAMEDULLARY EPIDERMOID CYST OF THE SPINAL CORD

REPORT OF A CASE WITH REMARKS ON EARLY DIAGNOSIS

By MURRAY A. FALCONER and REGINALD S. HOOPER
(FROM THE NUFFIELD DEPARTMENT OF SURGERY, OXFORD)

Epidermoid and dermoid cysts occurring within the substance of the spinal cord are uncommon. As we have found only 9 examples in the literature we think it advisable to report a case in which such a cyst was successfully removed at operation with practically complete recovery. The case also provides an important example of early diagnosis of spinal cord tumour.

These cysts belong to a group of tumours which arise from developmental inclusions. The terminology which has been assigned to the group is confusing. They have been described as 'pearly tumours', cholesteatomas, dermoids, and epidermoids. The term 'pearly tumour' refers to their external appearance, while the name of cholesteatoma indicates that many of the cysts contain cholesterin. Both of these terms, however, refer to non-essential characteristics. Most pathologists, therefore, prefer the terminology of Bostroem (1897), who divided them into epidermal cysts composed exclusively of epidermal cells and dermoid cysts containing also epidermal appendages such as hair and sebaceous material. Bostroem believed that during the formation of the neural tube inclusions of epidermal cells may arise when the neuro-ectoderm splits from the ectoderm which forms the skin, and that these inclusions later develop into epidermoid and dermoid cysts. Most of these cysts have been found in relation to the brain, several have been described compressing the spinal cord or cauda equina, and a few within the substance of the spinal cord itself.

The case which we wish to describe is one of simple epidermoid cyst occurring within the upper thoracic spinal cord.

CASE REPORT

History.—The patient, A. C., aged 32 years (R.I. No. 6824) was a mechanic engaged assembling gear-boxes in an automobile factory. He was admitted to the Radcliffe Infirmary on February 15, 1940, complaining of gradually progressive stiffness and weakness of the left leg. There were no relevant features in the previous personal or family history. Six months before admission he had first noticed that when walking his left knee felt stiff and would not bend easily. The stiffness of the knee gradually increased so that he had difficulty in compressing the powerful clutch springs of gear-boxes which he was assembling. However, he was able to walk readily for long distances, although there was a tendency to drag his left foot. Sometimes his left leg would tremble spontaneously and would continue to tremble until he put his whole weight upon it. He had not noticed any abnormality of his right leg, or disturbance of micturition or defæcation. He had not experienced any pain or paræsthesias in his limbs or trunk. His general health was good.

On Examination.—He appeared to be a well-built, healthy-looking, intelligent adult. The abnormal physical signs were confined to the trunk and lower limbs. In the trunk the only definite sign was a diminution of the abdominal reflexes on the left side; there was no impairment of sensibility to pin-prick, cotton-wool, or temperature, no evidence of spinal

deformity or tenderness, and the muscular functions of the trunk were normal. In the lower limbs signs of impaired motor function could be demonstrated. The left leg showed slight generalized wasting when compared with the right ($\frac{1}{2}$ in. difference in the circumference of the calves). On sudden exposure to cold air a coarse fascicular tremor could be induced in both legs, particularly on the left side, where it involved the lower abdominal and gluteal muscles as well. There was a slight to moderate degree of weakness and spasticity of the left leg, particularly for movements of the distal joints, and a very slight degree of spasticity and weakness of the right leg. Both knee- and ankle-jerks were exaggerated, more so on the left side than on the right, both plantar reflexes were extensor, and ankle- and knee-clonus were demonstrable on the left side but not on the right. On walking the left leg dragged slightly. Sensibility in the lower limbs was tested by cotton-wool, pin-prick, temperature, vibration, two-point discrimination test, and *Zahlenschreiben*, but no loss was detected. The X-ray appearances of the spinal column were normal. The Wassermann reaction in the blood and cerebrospinal fluid was negative.

These findings of an asymmetrical spastic paraplegia without pain or sensory changes and without disturbance of sphincteric control suggested a diagnosis of amyotrophic lateral sclerosis. However, lumbar puncture showed a partial manometric block. The initial pressure was 110 mm. of water. On abdominal compression there was a brisk rise and fall of 50 mm., but on bilateral jugular compression the pressure slowly rose only by 15 to 20 mm. The cerebrospinal fluid contained 35 mg. of protein per 100 c.c. and no cells. These observations were repeated and confirmed by two independent observers.

This demonstration of a positive Queckenstedt test suggested the presence of a tumour, but the only indication of its level was the diminution of the left abdominal reflexes, which

FIG. 342.—Lipiodol examination of spinal column in head-low position, showing filling defect opposite 3rd thoracic vertebra.

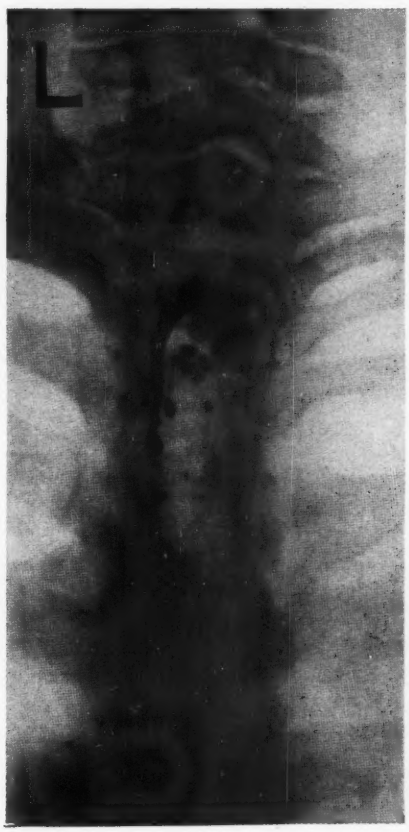


FIG. 343.—Later stage of lipiodol examination of spinal column in feet-low position, showing upper level of filling defect opposite 2nd thoracic vertebra.

indicated that the lesion must lie above the 6th thoracic segment. An injection of 4 c.c. of lipiodol was therefore made into the lumbar subarachnoid space and the patient was then transferred to a tilting X-ray table. When the patient was tilted head downwards 70° below the horizontal, the lipiodol was held up at the level of the upper border of the 3rd thoracic vertebra (*Fig.* 342). A small amount of lipiodol slipped beyond the block and later, when the patient's feet were tilted below the horizontal, outlined the upper margin of the block (*Fig.* 343). The examination was repeated with the patient in both the prone and the supine positions, similar observations being made on each occasion. The appearances suggested a spherical lesion centrally placed within the spinal theca at this level. A diagnosis of spinal cord tumour, probably intramedullary, was therefore made.

Following this procedure sensory signs became apparent for the first time. These signs comprised a zone of relative anæsthesia and analgesia involving the 3rd to 6th thoracic

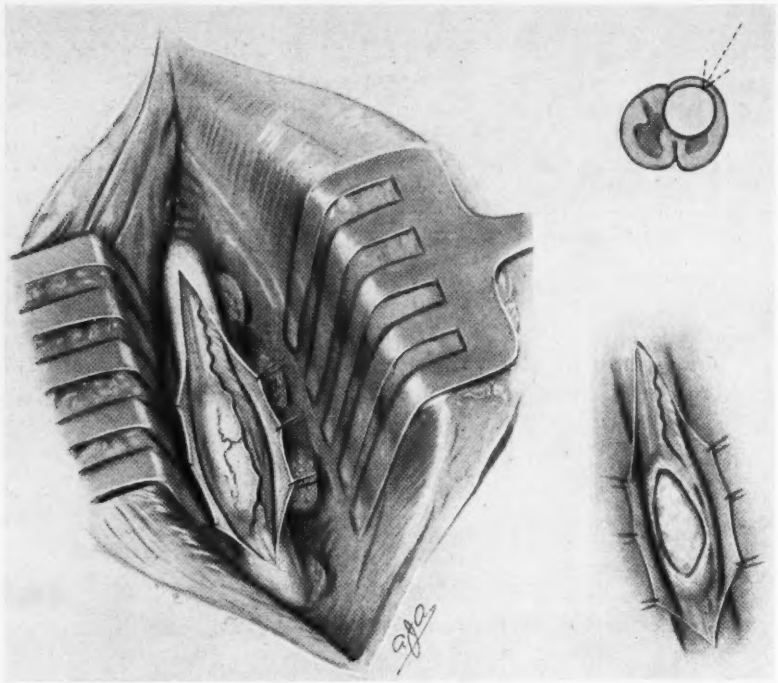


FIG. 344.—Sketch illustrating the appearances seen at operation. Shows localized swelling of the spinal cord opposite the 2nd and 3rd thoracic vertebræ. *Upper inset*: Schematic cross-section of spinal cord, showing route of approach to tumour. *Lower inset*: Shows the appearance following removal of the tumour.

segmental areas and slight impairment of vibration and postural sensibility in both lower limbs. Sweating tests, which prior to the lipiodol examination had not shown any significant abnormality, now disclosed a definite diminution in sweating on the left side of the body below the 3rd thoracic segmental area.

OPERATION.—On February 22 Mr. J. B. Pennybacker performed a laminectomy, removing four spines and laminæ in the upper thoracic region. An intramedullary tumour was found at the level of the 2nd to 3rd thoracic vertebræ (*Fig.* 344). Its outline was visible through the unopened dura and it was covered posteriorly by a very thin semitranslucent layer of white matter representing the left posterior column. It was glistening, greenish-yellow, circumscribed, and measured 2 cm. long by just under 1 cm. in diameter. The bulk of the tumour lay to the left of the midline. Its interior consisted of soft avascular cheesy material, which was removed piecemeal. The capsule was then stripped easily from the surrounding cord. After the tumour had been completely removed cerebrospinal fluid flowed freely on jugular compression.

PATHOLOGY.—Dr. A. H. T. Robb-Smith reported as follows: The specimen (R.I. H258–40) consisted of a number of fragments of material of which the total volume, when fixed, was 2·4 c.c. They varied in character from white nacreous flakes to a portion of tissue 1 × 1 × 0·8 cm. This was a fragmented spheroid with a light-brownish nacreous surface and on bisection it was found to be partially cystic, the cavity lying eccentrically. The wall was made up of laminated material alternating zones of brown and white with iridescent flecks.

Microscopically the appearances of all the portions examined are essentially similar (*Fig.* 345). There is no organoid arrangement, but the tissue consists of closely set anuclear squames which are much flattened, producing a laminated appearance. The laminæ form a pattern varying from gentle curves to sharp serrations. Between the laminated squames numerous vesicles are to be seen which are well defined when 35 μ in diameter. The small vesicles appear empty in paraffin-embedded material. These vesicles coalesce to form cysts of varying sizes up to several millimetres in diameter; within these cysts there is much acidophil and sudanophil debris, cholesterol crystals, erythrocytes, and an occasional macrophage. As the material was received in fragmented form, it was not possible to identify the 'capsule'. Naked-eye and microscopical examination does not suggest any essential difference from one zone to another or any especial condensation. No neuroglial tissue or collagen is present in the portions examined. In certain areas the laminated squames appear to be undergoing calcification and in these zones calcospherites lie between the laminæ. In other areas the laminæ have spread or are cut in a different plane and the pattern of the individual squames can be recognized. The histochemical reactions of the squames suggest that they are formed of keratin, but there is much sudanophil material between the squames and in the cysts. The appearances are those of a cystic epidermoid.

FIG. 345.—Photomicrograph of the tumour, showing the laminated epithelial squames, the interlaminar vesicles, the cystic spaces containing amorphous material, and clefts where cholesterol crystals have been dissolved. (Hæmatoxylin and eosin.) (× 45.)

POST-OPERATIVE COURSE.—An hour after operation the patient was able to move both lower limbs, but they were spastic. On the following day it was impossible to demonstrate any sensory loss to pin-prick, cotton-wool, or vibration, although there was a raised threshold to change of posture in the toes. The motor functions of the lower limbs had not altered from before operation. The patient passed urine without difficulty.

Thereafter he had a straightforward afebrile convalescence. The spasticity of the legs became less marked, while the motor power slowly improved. He was allowed up on the thirteenth post-operative day, and three days later he was walking about without assistance. The right leg appeared normal, but the left leg still dragged slightly and showed occasional coarse fascicular tremors. The knee-jerk and ankle-jerk were still exaggerated on the left side and the plantar response extensor, but the motor power had improved and ankle-clonus could no longer be demonstrated. No sensory abnormalities could be detected. A post-operative lumbar puncture revealed that the cerebrospinal fluid was normal and that there was no evidence of manometric block. The operative wound had healed soundly.

The patient returned to work two and a half months after operation. A fortnight later he reported for follow-up examination. He said that he was now engaged assembling marine engines and doing his job satisfactorily with no disability in his walking. On examination slight weakness could still be detected in the left ankle, but there was no inco-ordination of movement and the gait was normal. The knee- and ankle-jerks on the left side were a shade brisker than on the right. The left plantar response was still feebly extensor, while the right plantar response was flexor. The abdominal reflexes were diminished over the left

lower quadrant but brisk over the rest of the abdomen. No sensory or sphincteric abnormalities were present. Lumbar puncture was repeated and again disclosed a normal cerebrospinal fluid without manometric block.

DISCUSSION

The epidermoid and dermoid cysts of the spinal cord which are recorded in the literature were reviewed by Gross (1934), by Bradford (1938), and by Boldrey and Elvidge (1939). About 40 cases have been reviewed, most of which were extramedullary or in the cauda equina. Only in 9 cases was the cyst situated within the substance of the spinal cord; 6 of these were epidermoid cysts and 3 were dermoid cysts. These intramedullary cysts occurred at various levels in the spinal cord and caused symptoms and signs similar to those seen with other types of intramedullary tumour. With one exception, a case of dermoid cyst occurring in an anencephalic monster reported by Ivanoff, these cysts, as also in our case, all occurred in males. One was found in a child (Bradford) and the remainder in adults whose ages, with the exception of one patient aged 71 years, ranged from 26 to 44 years and who gave histories of slowly progressive paraplegia dating back from 1 to 20 years. Of the 9 cases 6 were submitted to laminectomy and improvement subsequently occurred in 3 cases—Bradford; Gross; Puech, Plichet, Visalli, and Brun (1936).

Of these cases one reported by Puech and associates bears many resemblances to our case, though it was in a more advanced stage. Their case was a male aged 37 years who was referred to the clinic of Clovis Vincent with spastic paraplegia, objective sensory impairment below the 6th or 7th thoracic segmental areas, paræsthesias in the legs, and difficulty of micturition. These symptoms had come on gradually during the preceding year and had progressed until he was unable to walk without assistance. On lumbar puncture a partial manometric block was disclosed and the cerebrospinal fluid appeared normal (cells 3 per c.c., protein 30 mg. per 100 c.c.). Laminectomy revealed an intramedullary cyst at the level of the 6th or 7th thoracic vertebræ. The operative findings and the type of procedure carried out were practically identical with those described for our case. The tumour weighed 4 g., and from the illustrations and histological description seems to have been an epidermoid cyst similar to the one we have reported. Following operation improvement slowly took place until complete recovery was eventually established.

Our case differed from this case of Puech and his associates in that there were no sensory or sphincteric disturbances and the degree of motor impairment was less. Evidently our patient had come under observation at an earlier stage. When first seen he might readily have passed as a case of amyotrophic lateral sclerosis and have been allowed to continue without operation until the appearance of sensory and sphincteric disturbances made it evident that the diagnosis was mistaken. That this was not the sequence of events was due to the use of two diagnostic procedures, first, the routine employment of the Queckenstedt test, and second, lipiodol examination of the spinal cord.

Observations of the intrathecal pressures during bilateral jugular compression revealed the association of an incomplete manometric block with a normal cerebrospinal fluid. This association is unusual because generally the protein content of the lumbar fluid is increased when there is a manometric block. Examination of the records of this clinic shows that dermoid and epidermoid cysts in the cerebellopontine angle and ventricles are usually associated with a normal lumbar fluid. In

the spinal cases in the literature few accurate protein determinations have been recorded. In Puech's case there was an incomplete block and normal lumbar fluid. In the case reported by Gross, however, the protein content of the lumbar fluid was raised to 74 mg. per 100 c.c. without a block being present. Both of these cases, like our case, were intramedullary cysts in the upper thoracic portion of the spinal cord. In view of the case of Gross it is clear that the association of manometric block and normal lumbar fluid is not invariable in spinal dermoids, and, furthermore, we have recently observed it in a case of meningioma compressing the mid-thoracic cord.

Our case emphasizes a very important diagnostic principle, the necessity for the routine performance of lumbar puncture and Queckenstedt's test in every case presenting progressive spinal cord symptoms, even in the absence of any sensory signs. The second step of lipiodol examination of the spinal column followed logically once the fact of an incomplete manometric block was conceded, because accurate localization of the block would not have been possible by any other method. After this experience we are led to wonder how often cases in which a diagnosis of amyotrophic lateral sclerosis has been made, eventually turn out to be cases of spinal cord tumour.

Our thanks are due to Professor Hugh Cairns and Mr. J. B. Pennybacker for assistance in the presentation of this paper; to Dr. F. H. Kemp for radiological reports; and to Dr. A. H. T. Robb-Smith for pathological reports.

REFERENCES

BOSTROEM, E., *Zentralb. f. allg. Pathol. u. Pathol. Anat.*, 1897, **8**, 1.
BOLDREY, E. B., and ELVIDGE, A. R., *Ann. of Surg.*, 1939, **110**, 273.
BRADFORD, F. K., *Ibid.*, 1938, **107**, 107.
GROSS, S. W., *Jour. Nerv. and Ment. Dis.*, 1934, **80**, 274.
IVANOFF, N. S. (1903), quoted by GROSS and by BOLDREY and ELVIDGE.
PUECH, P., PLICHET, A., VISALLI, F., and BRUN, N., *Rev. neurol.*, 1936, **66**, 56.

A CASE OF LIVER 'SEQUESTRUM' COMPLICATING SUBCUTANEOUS RUPTURE OF THE LIVER*

By RUSCOE CLARKE

FIRST ASSISTANT IN SURGERY AT THE BRITISH POST-GRADUATE MEDICAL SCHOOL

SUBCUTANEOUS rupture of the liver is no rarity. Krieg[1] in 1936 described 60 cases. The mortality for the whole group was 61·6 per cent. The mortality for those operated upon was 56·6 per cent. Deaver and Ashurst[2] report a mortality of 80 per cent for cases not operated upon, and 60 per cent for those subjected to operation. Many patients with exceptionally large tears in the liver have recovered. The present case is of particular interest, however, on account of the sequel of separation of the liver 'sequestrum', which was removed at a second operation. The case is presented with details of circulatory studies carried out by the team (under Dr. J. McMichael) responsible for the treatment of the shock and blood loss.

CASE REPORT

HISTORY.—J. E. I. A., male, unmarried, aged 18, was admitted to Hammersmith Hospital at 11 a.m. on September 12, 1940. Two hours previously he had been knocked down by an Army lorry, one wheel of which passed over his abdomen. He was pale, sweating, fully conscious, and complained of abdominal pain. He had not vomited. Respirations were shallow (rate 30). The pulse was rapid (rate 120), its volume poor. There was a small laceration in the right groin. No bruising or sign of fracture. Examination of heart, lungs, and central nervous system showed no abnormality.

The abdomen moved poorly on respiration. Generalized tenderness and muscle spasm were present, most marked in the right upper quadrant. No mass could be felt. Shifting dullness was not demonstrated.

A diagnosis of "probable rupture of the liver" was made. Treatment for shock was instigated immediately, consisting of morphine sulphate, $\frac{1}{4}$ gr. hypodermically, and 540 c.c. of recalcified citrate serum (Clegg and Dible[3]) intravenously. The systolic blood-pressure, which had fallen from 125 on admission to 96, rose to 136. The pulse improved in volume and its rate fell to 100. Exploration was advised. His condition at this time was excellent. Abdominal spasm had disappeared, but marked tenderness in the right upper quadrant persisted. The anæsthetic was started at 12.33 p.m.

AT OPERATION.—Pre-medication consisted of atropine $\frac{1}{100}$ gr., and the anæsthetic was endotracheal gas and oxygen.

The wound in the groin was excised, found not to communicate with the abdomen, and sutured. The abdomen was opened through a right supra-umbilical paramedian incision about 4 in. long, and a large quantity of blood escaped. The spleen and kidneys were palpated and found to be intact. A tear in the liver was felt and packed temporarily, while the exploration of the abdomen was completed. No other damage was found. The incision was enlarged upwards and the tear in the liver found to extend from the diaphragm posteriorly through the left lobe just to the left of the fissure for the falciform ligament, around the anterior border on to the inferior surface, and so into the portal fissure. The depth varied from $1\frac{1}{2}$ in. to 4 in. The major portion was closed with deep mattress sutures of stout catgut, using blunt-ended liver needles, which fortunately happened to be available. The falciform ligament was included in a number of these sutures to enable a better grip to be obtained and to prevent cutting out. A small part of the tear, far back near the diaphragm, could not be reached. This was lightly packed with gauze. Blood still flowed freely from

* From the Department of Surgery, British Post-Graduate Medical School.

the portal fissure, which also was gently packed. The wound was closed in layers, leaving the ends of the packing protruding at the upper end.

POST-OPERATIVE PROGRESS.—The operation was finished at 2.5 p.m. The pulse had risen to 140 and remained up until the following day. The blood-pressure had fallen to 60, but following intravenous therapy rose rapidly to 110. The hæmoglobin fell to 60 at the end of the operation, rose to 110 the next day, and fell to 75 by the third day, after which steady return to normal ensued. The immediate post-operative blood-volume (determined by Hill's concentrated corpuscle method[4]) was 1·29 l. This is the lowest reading obtained so far in this clinic since careful studies of traumatic shock and hæmorrhage have been undertaken. The blood lost at operation, as estimated by soaking out swabs, etc., and determining the hæmoglobin colorimetrically, amounted to 2·4 l. (this observation certainly erred on the low side). This loss was promptly replaced, the patient receiving 1480 c.c. of blood between 2.30 p.m. and 3.30 p.m. and a further 540 c.c. as a drip during the night—a total of 2020 c.c. post-operatively.

The immediate post-operative course was uneventful, except for slight drowsiness which persisted for several days. Renal function was not seriously disturbed. On September 15, 1940, from midnight to midnight he drank 71 oz. of fluid and passed 48 oz. of urine. The

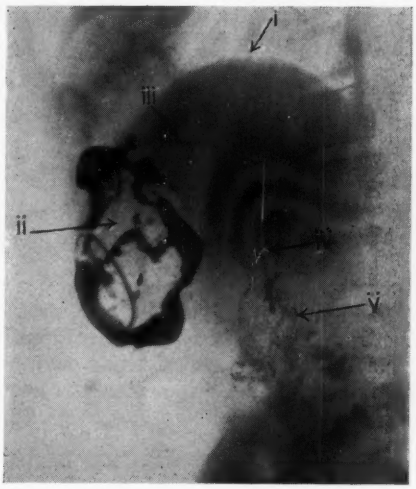


FIG. 346.—Lipiodol radiograph (lateral). i, Diaphragm; ii, Cavity with filling defect; iii, Bile tributary; iv, Common duct; v, Duodenum.

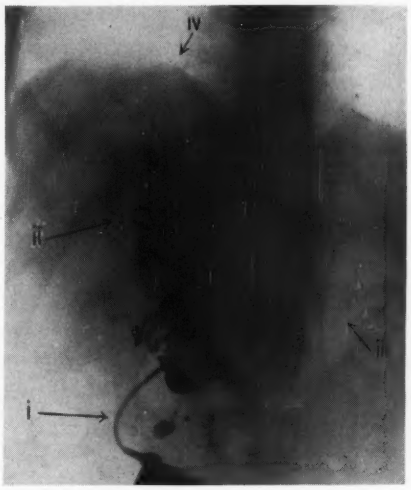


FIG. 347.—Lipiodol radiograph (antero-posterior.) i, Catheter; ii, Communications with bile-ducts; iii, Stomach; iv, Diaphragm.

plugging was allowed to remain in place for five days and was then withdrawn a small amount at a time. Discharge of bile followed, and several days later a brisk hæmorrhage took place. This stopped after morphia alone.

The plugging was all out by the seventeenth day (September 29). Post-operatively the pulse-rate fell steadily to 90. The temperature fluctuated around 99° F.

On the twelfth day (September 24) he began to complain of pain in the right side of the chest. This was associated with diminution of resonance and breath-sounds at the right base. Radiography showed elevation of the right diaphragm and deflation of the right middle lobe. He was given expectorants and encouraged to cough, and X-ray examination on October 3 showed complete re-inflation of the right lung.

About this time the patient began to complain of abdominal pain. The wound had healed except for a small discharging sinus at its upper end. The bile leakage had ceased and thick pus alone escaped. The upper abdomen around the wound was tender, and this tenderness spread gradually into the flanks. On October 14 the urine showed only a few leucocytes and no organisms. From October 12 to October 16 the temperature rose gradually and tenderness increased. Copious discharge from the sinus persisted. On October 17 a soft rubber catheter was introduced into the sinus without difficulty for about 8 in. An injection of 20 c.c. of lipiodol was made. Radiological examination then showed a large

intra-abdominal cavity encroached upon by a filling defect (*Figs.* 346, 347). The lipiodol from this cavity could be traced into a tributary of the bile-duct and down the common duct into the duodenum. Exploration was considered necessary. This was carried out on the thirty-seventh day (October 19, 1940), under general anæsthesia. The sinus track was dilated and the wound above it re-opened. The abscess cavity was found to be occupied by a completely separated liver 'sequestrum', size 9 × 6 × 1 cm. (*Fig.* 348).

FIG. 348.—Photograph of specimen.

The cavity was loosely packed with gauze. This was extruded gradually and healing took place without further delay.

Section of the specimen showed it to be "liver tissue, completely necrotic, but not autolysed".

The patient was discharged from hospital on November 16, sixty-five days after the accident. The wound was completely healed by November 23. Pre-operative and post-operative changes in blood-pressure, pulse-rate, and hæmoglobin are shown in the accompanying chart (*Fig.* 349).

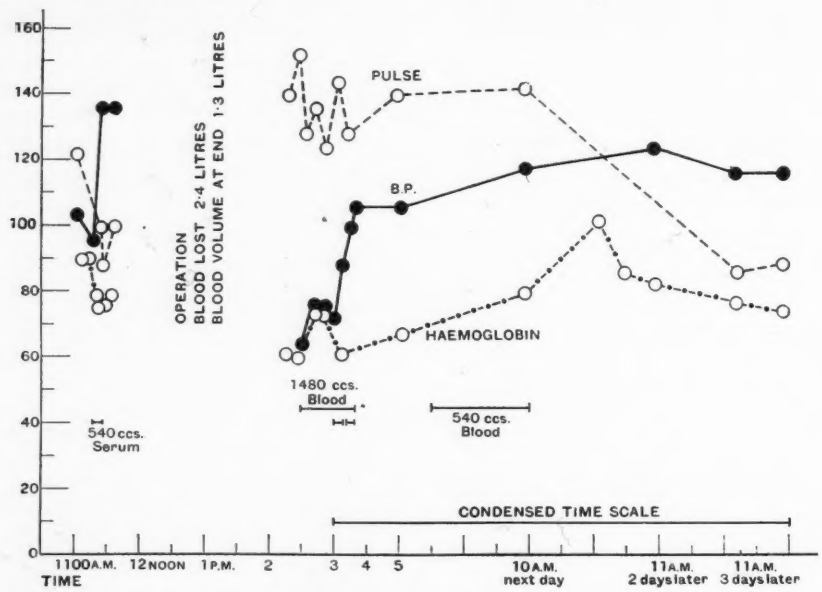


FIG. 349.—Chart of hæmoglobin, blood-pressure, and pulse-rate readings.

COMMENTARY

While recovery after severe injury of the liver is not rare, this case is of interest from several points of view :—

1. Careful blood studies illustrated forcibly the degree of exsanguination from which rapid recovery is possible. The normal adult blood-volume varies between 4 and 5 l. In view of his height (5 ft. 3 in.) and slight build the total blood-volume of this patient was probably in the neighbourhood of 4 l. According to our calculations the blood lost amounted to 2·4 l. This was rapidly replaced without subsequent ill effects. A total of 2·56 l. of blood and serum was introduced. The blood-volume determined at the end of the operation was 1·3 l. (approximately). The margin of error by this technique[4] is probably within 20 per cent, so that this represents a blood-volume at the end of operation of at most 1·6 l. out of a total of 4 l., equal to 40 per cent. It is certain that many of our casualties are worse off than this, yet must not be despaired of. Such cases require large quantities of blood administered rapidly.

2. Complications of pulmonary atelectasis, and hæmorrhage following even gentle removal of the packing, are not unusual. Grey Turner,[5] in a recent paper on abdominal injuries, stresses the need for such care in the removal of packing : " It should not merely be drawn out at a stated time but should be loosened by gentle traction on the edges, and if this process can be accomplished and is not accompanied by bleeding it may be persevered with until the whole is removed. As a rule a big pack used for the control of hæmorrhage can only be removed in two or three sittings."

3. The complication of liver ' sequestrum ' is of greater interest, not alone on account of its comparative rarity. No specific case is described in the recent literature. Branch[6] in 1938 described a case in which a piece of necrotic liver was left in at the time of operation, and since the patient recovered was presumably absorbed later. In the chapter on the liver in *Post-graduate Surgery*,[7] Dickson Wright states that in the dog, when a piece of separated liver is left in the peritoneal cavity, death inevitably follows within twenty-four hours from an overwhelming " foaming " *B. welchii* peritonitis.

In our case separation probably occurred gradually, by which time the general peritoneal cavity was shut off. The transverse tear in the neighbourhood of the portal fissure may have been responsible for interfering with the blood-supply more than the main sagittal tear. The packing in the portal fissure probably played a part. We do not think that our sutures can be regarded as in any way to blame, although it may be noted that excellent hæmostasis was obtained by using the falciform ligament instead of omentum to prevent these cutting out. Subsequent visualization of the abscess cavity by lipiodol requires no special comment, although it is of interest to observe how accurately the filling defect corresponds in shape to the loose portion of the liver.

SUMMARY

A case of subcutaneous rupture of the liver complicated by liver ' sequestrum ' is described. The case illustrates the possibility of recovery after very severe depletion of circulating blood-volume. The ' sequestrum ', which separated without severe constitutional disturbance, was visualized as a filling defect in a lipiodol radiograph of the abscess cavity. Removal was followed by complete recovery.

My thanks are due to Dr. Allen Daley, Chief Medical Officer of the London County Council, for permission to publish this case; to Professor G. Grey Turner and Mr. A. K. Henry for their advice; and to Dr. J. McMichael and the Medical Unit for their interest and assistance.

REFERENCES

[1] KREIG, E. G., "Hepatic Trauma", *Arch. of Surg.*, 1936, **32**, 907.
[2] DEAVER, J. B., and ASHURST, A. P. C., *Surgery of the Upper Abdomen*, 2nd ed., 1921, 598.
[3] CLEGG, J. W., and DIBLE, J. HENRY, "Preparation and Use of Human Serum for Blood Transfusion in Shock", *Lancet*, 1940, **2**, 294.
[4] HILL, D. K., "Determination of Blood Volume in Shocked Patient", *Lancet*, 1941, **1**, 177.
[5] TURNER, G. GREY, "Some Notes on Abdominal Injuries", *Brit. Med. Jour.*, 1940, **1**, 679.
[6] BRANCH, CHARLES D., "Injury of the Liver", *Ann. of Surg.*, 1938, **107**, 475.
[7] *Post-graduate Surgery*, 1936, 739. London: Medical Publications Ltd.

THE DUMB-BELL TUMOURS OF THE SPINE *

By KENNETH EDEN, London

In general it is undesirable to make use of crudely descriptive terms when describing pathological conditions. There are, however, a number of spine tumours which, owing to their peculiar shape and relationship to the spinal canal, present special features in diagnosis and treatment, justifying their consideration as a separate group of dumb-bell or hour-glass tumours. In addition to these types which lie partly inside the vertebral canal and partly outside it, there are others which lie astride the dura mater, and have no characteristic clinical features, but are closely related to, and sometimes associated with, the other forms under consideration, and are therefore included under the same title.

It is not intended in this study to describe the historical aspect of the subject, which has been dealt with in detail by Heuer (1929), but rather to define the main pathological types of dumb-bell tumour, and to correlate the details of their morbid anatomy with their symptomatology and treatment. In addition, the changes produced by these tumours in the surrounding bone of the vertebral column are of special interest, and since a large proportion are neurofibromata, either of the solitary or multiple type, it is pertinent to inquire into the relationship of these bone changes to the spinal deformity of neurofibromatosis.

ANATOMICAL TYPES

Four main anatomical groups of dumb-bell tumour of the spine may be defined (*Fig.* 350). In the first the tumour is entirely within the spinal canal but partly inside and partly outside the dura mater, the connecting piece being a broad waist of tumour substance or infiltrated dura mater. In the other types, the intra- and extraspinal lobes are connected by a narrow stalk passing through a foramen, or rarely between two laminæ (a). The paravertebral tumour may lie in the muscles of the back, in the neck, mediastinum, abdomen, or pelvis. Occasionally there are two separate extraspinal lobes, one lying laterally to the spine with a process passing through a foramen, and one embedded in the muscles of the back but arising from the same stalk (b), or from a process extending between two eroded laminæ. The fourth type lies almost entirely outside the spine, with only a small extension into a vertebral foramen.

INCIDENCE OF PATHOLOGICAL TYPES

Since the term 'dumb-bell tumour' is descriptive only, it leaves out of consideration the pathological nature of these tumours. Theoretically they might be thought to arise from any of the structures in or around the spine, the

* Based on a Hunterian Lecture delivered at the Royal College of Surgeons on February 7, 1940, and on work carried out as John Marshall Fellow in Surgical Pathology in the University of London, University College Hospital.

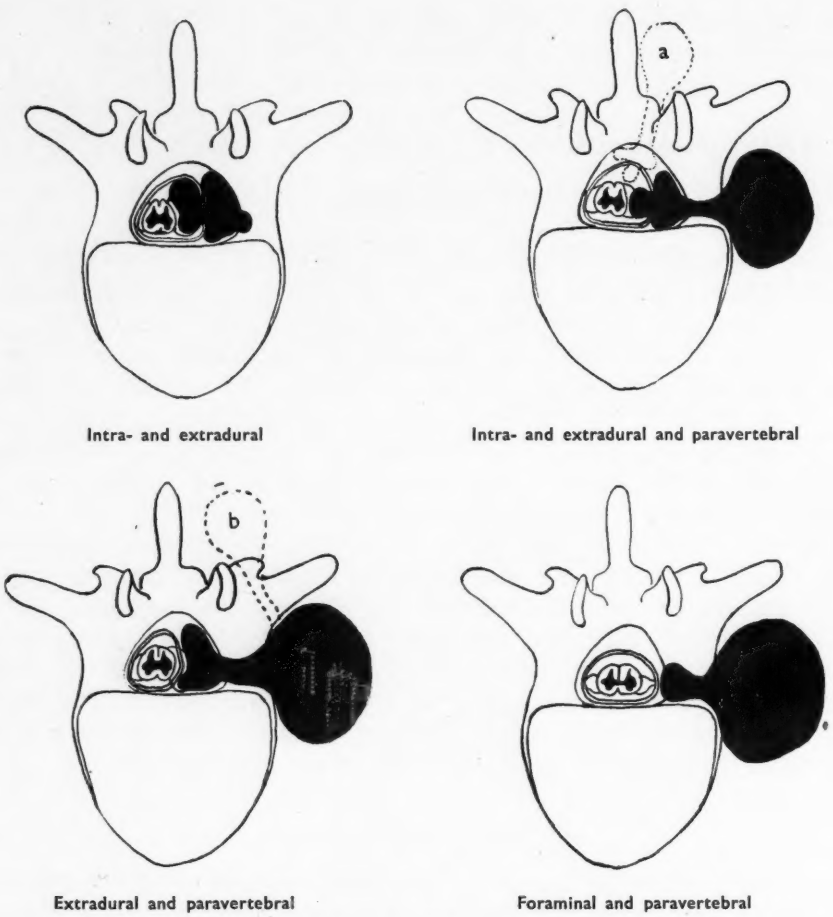


FIG. 350.—Diagrams of the anatomical types of dumb-bell tumour.

intraspinal forms growing through a foramen into the surrounding tissues, and the paravertebral forms worming their way into the spinal canal. A large variety of such tumours have in fact been described, but in some cases the pathological diagnosis is open to question, and in others the characters are rather those of malignant infiltrating tumours of bone. It is better to confine the term ' dumb-bell tumour ' to those tumours which cause pressure erosion of bone, but do not infiltrate or arise from it. They must therefore be distinguished from primary and secondary malignant growths of bone invading the spinal canal and surrounding structures, and such conditions as lymphosarcoma, lymphadenoma, and retroperitoneal sarcoma, which may creep into the spinal canal and invade the vertebræ, but have no real resemblance to the tumours under consideration.

Table I shows an analysis of a series of 234 spinal tumours to show the incidence of dumb-bell types. There were in all 32 examples of dumb-bell tumours, of which 25 were neurofibromata. Of these, there were 18 solitary neurofibromata out of a total of 76 cases, as compared with only 3 out of 74 cases of meningioma; while 7 out of 19 cases of proved neurofibromatosis of the spine showed dumb-bell types. Of the remaining cases, 2 were hæmangio-endotheliomata, similar to the

cases described by Naffziger and Brown (1933), and one was a ganglioneuroma, examples of which have also been described by Loretz (1870), Rapp (1913), Stout (1924), Cushing and Wolbach (1927), and Naffziger and Brown (1933). The remaining tumour was described as an endothelial-celled sarcoma and is of doubtful origin, but has been included because it was of the intra- and extradural type, quite dissociated from the surrounding bone.

Table I.—THE INCIDENCE OF DUMB-BELL TUMOURS IN A SERIES OF 234 SPINAL TUMOURS *

TYPE OF TUMOUR	TOTAL SPINAL TUMOURS	NUMBER OF DUMB-BELL TUMOURS	INTRA- AND EXTRADURAL TUMOURS	INTRA- AND EXTRADURAL AND PARA-VERTEBRAL TUMOURS	EXTRADURAL AND PARA-VERTEBRAL TUMOURS	FORAMINAL AND PARA-VERTEBRAL TUMOURS
Solitary neurofibromata	76	18	8	6	3	1
Multiple neurofibromata	19	7	1	2	4	0
Meningiomata	74	3	3	0	0	0
Ganglioneuromata	1	1	0	0	1	0
Miscellaneous extra-medullary tumours	19	3	1	0	2	0
Intramedullary tumours	45	0	0	0	0	0
TOTAL CASES	234	32	13	8	10	1

* This table comprises a series of spinal tumours treated at the National Hospital, Queen Square, and University College Hospital, during the last twenty years. The malignant tumours of bone, primary and secondary, and such conditions as lymphadenoma and lymphosarcoma have been excluded, because they are seldom operated on and do not always come to autopsy in hospital. Prolapsed intervertebral discs, which only recently have been differentiated from true chondromata and for which accurate figures are not therefore available, have also been omitted.

Many cases have been described in the earlier literature as fibromata (Zinn and Koch, 1900; Boerner, 1902; Schultze, 1903; Carman and Davis, 1924), and as fibrosarcomata (Lannois and Durand, 1906; Bing and Bircher, 1909; Nonne, 1910; Guleke, 1916 and 1922; Elsberg's Case 55, 1925), or in one case as a leiomyoma (Elsberg's Case 40, 1925), many of which were probably really neurofibromata, although it is possible that true fibrosarcomata may occasionally arise in the ligaments of the spine, and form dumb-bell extensions.

The only one of these alleged fibrosarcomata which I have been able to verify personally, is the specimen in the Museum of the Royal College of Surgeons which was obtained from Dowse's case (1874) (No. 5067, 1), and is described in the catalogue as a dumb-bell tumour of fibrosarcomatous origin growing from the dura mater of the cervical spinal cord. The sections which I have taken from this specimen, by kind permission of the Curator of the Museum, show it to be an undoubted neurofibroma, although the arrangement of the collagen fibres is rather more plexiform than usual. Other cases described as giant-celled sarcomata (Elsberg's Case 58, 1925; Dandy, 1925), psammosarcomata (Elsberg's Case 67, 1925), and angiosarcomata (Dandy, 1925), may I think be dismissed as examples of malignant bone tumours, or of inaccurately described benign tumours belonging to one of the groups already defined.

In addition there are a number of recorded cases of round-celled tumours (Collins and Marks, 1899; Bruns, 1912; Brunschweiler, 1917), the nature of which, like the endothelial-celled sarcoma in this series, is uncertain.

PATHOLOGICAL HISTOLOGY AND MODE OF ORIGIN

The first three groups of tumours in the table, the solitary and multiple neurofibromata and meningiomata, which comprise 28 out of 32 of the dumb-bell tumours, have a close histological relationship. Much discussion has centred around their origin, but the view now most widely accepted is that advanced by Mallory (1919), who showed by cytological studies that they are derived from a common cell, the fibroblast. Penfield (1927), who later elaborated this theory, suggested the name of perineurial fibroblastoma for the solitary neurofibromata, denoting their origin from the perineurial sheaths, while retaining the term neurofibroma for the multiple tumours which may arise from any of the connective-tissue nerve-sheaths. As a result of this, he stated, the multiple neurofibromata may contain nerve-fibres running through their substance, while the perineurial fibroblastomata only contain them in the capsule. Though this may often be true, many of the neurofibromata in von Recklinghausen's disease only contain nerve-fibres in the capsule, and are indistinguishable from the solitary type. It is sufficient to say for present purposes that both forms arise from the connective-tissue nerve-sheaths, and that, especially in the multiple form, the origin may be diffuse.

The meningiomata, which Penfield termed the meningeal fibroblastomata, arise from the connective tissue of the arachnoid, and not in relation to the nerve-sheaths. As a result, the cells and collagen fibres, though essentially similar to those of the neurofibromata, are not arranged in rows and streams, but in concentric whorls like the cells of the arachnoidal granulations.

1. Dumb-bell Meningiomata.—Owing to their relationship to the arachnoid membrane, the meningiomata arise as a rule intradurally, but are frequently attached to and may infiltrate the dura mater. This is an important difference from the neurofibromata, which arise along the course of a nerve; and has a bearing on the relative frequency of dumb-bell types in the neurofibromata and meningiomata. Dumb-bell meningiomata are uncommon and are limited to the intra- and extradural variety. They are found by infiltration of the dura by the tumour before it breaks through on the outside to form a secondary extradural lobe. The extradural tumour may erode the bone and creep into the foramina, but does not extend outside the spine to form a paravertebral lobe.*

2. Dumb-bell Neurofibromata.—In contrast to the meningiomata, dumb-bell neurofibromata are quite common, and comprise not only an appreciable proportion of all spinal neurofibromata, but include the majority of all types of dumb-bell tumours. Just as solitary neurofibromata are found arising from the nerves outside the spine, or in the extradural space, so dumb-bell tumours are found originating from the part of a nerve which passes through a foramen or the dura. As the tumour grows from this diffuse origin, one lobe is formed outside and one lobe inside the spinal canal or dura mater (*Fig.* 351). The lower resistance offered to

* It is true that extradural meningiomata are also found unassociated with any obvious intradural tumour. It seems probable, however, that these tumours arise where the dura mater and arachnoid are in intimate relationship, and invade the dura at once, without forming any proper intradural tumour. The main bulk of the tumour in these cases then lies in the extradural space and spreads in the form of a plaque, which may appear to have little connexion with the dura. There were, in fact, 5 cases of this type in the present series, in addition to the 3 dumb-bell tumours, but in only 1 case was the dura examined microscopically, and this was found to be infiltrated by the growth.

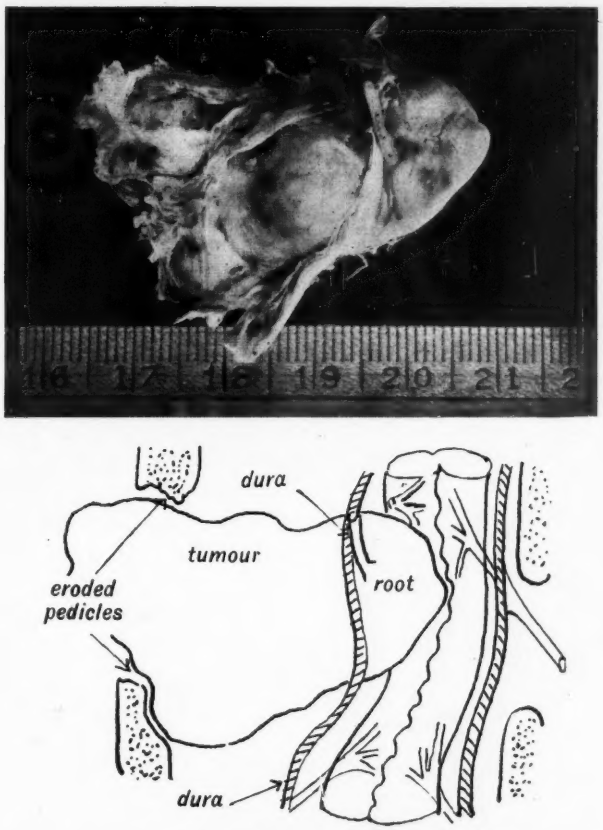


FIG. 351.—An intra- and extradural dumb-bell neurofibroma eroding a foramen, removed in one piece at operation.

FIG. 352.—Neurofibromatosis of the spinal nerve-roots, with multiple tumours (T) passing through enlarged foramina into the lumbosacral plexus (P). C, Cauda equina. (*Spec. No.* 5090, 1, *R.C.S. Museum.*)

the paravertebral lobe allows it to grow more rapidly than the portion inside the spinal canal, which is of necessity cramped. Hence the paravertebral lobe may attain much larger proportions.

When the tumour arises from the nerve just as it is leaving a foramen, a foraminal and paravertebral type results, with the greater bulk outside the spinal canal, and only a small intraforaminal lobe.

This mode of origin is also well illustrated by the multiple dumb-bell neurofibromata (*Fig.* 352, Specimen No. 5090, 1, R.C.S. Museum). In neurofibromatosis whole segments of a nerve are involved in tumour formation, and a chain of tumours may be formed extending from the spinal cord through the foramen in the course of the nerve-root, to blend with hypertrophied sympathetic chains and peripheral plexuses (*Fig.* 353). Sometimes two or more nerves are involved, as in the cases

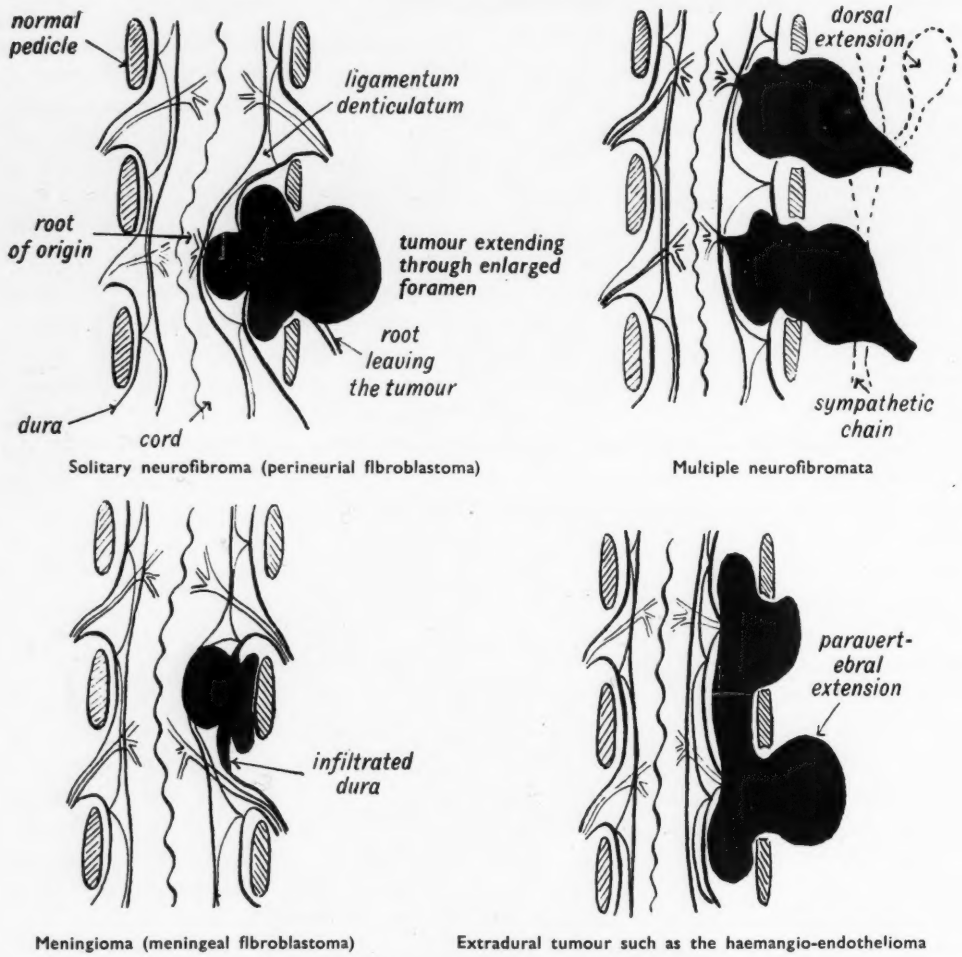


FIG. 353.—Diagrams of pathological types of dumb-bell tumour.

described by Antoni (1920) and Flateau and Sawicki (1922). In one such case in this series the patient complained of two swellings on the back of the head, which it transpired were part of a diffuse tumour formation in the course of the greater

and third occipital nerves, extending from the neck into the spinal canal and involving the roots at their origin from the spinal cord.

The same theory also accounts for the recorded cases (Dubujadoux and Chevalier, 1883; Guleke, 1916 and 1922) in which there were three parts to the tumour, one in the spinal canal, one in the mediastinum corresponding to the intercostal nerve, and one in the muscles of the back in the course of the posterior primary division of the nerve. It does not, however, account for the rare cases (Carman and Davis, 1924) in which the stalk of the tumour passes through the space between two laminæ, instead of through a foramen. These tumours are presumably formed when an extradural tumour escapes through the eroded roof of the spinal canal.

3. Dumb-bell Hæmangio-endotheliomata.—Direct extension of the primary tumour out of the spinal canal with the later formation of a secondary paravertebral lobe, also accounts for the occasional formation of a dumb-bell shape by such tumours as the hæmangio-endothelioma. This tumour arises in the extradural tissues, but may worm its way out of the spinal canal, through an eroded foramen, or between two laminæ. The paravertebral tumour may then only become palpable some time after the onset of paralysis, or after the removal of the spinal tumour. The following case was one of this type:—

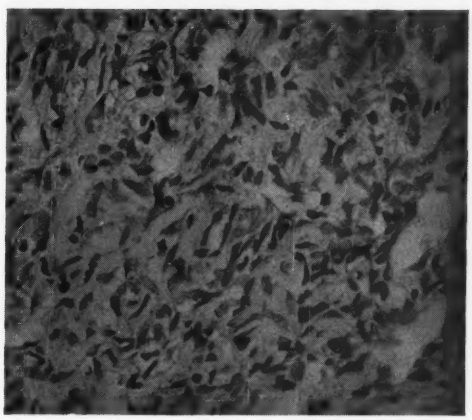


FIG. 354.—*Case* 1. Section of hæmangio-endothelioma. (H. and E.) (× 290.)

Case 1.—A man of 21 years complained of increasing numbness and weakness of the left hand for five weeks.

On examination, the neck was held stiffly and flexion caused a shooting pain radiating to the front of the chest. No mass was palpable in the neck. There was a spastic quadraplegia, more marked in the left arm than elsewhere, with slight flexion contracture of the fingers of this hand. There was a well-marked impairment to all forms of sensation below the level of the 4th cervical segment.

A radiograph of the cervical spine showed extensive erosion of the bodies and pedicles of C. 3, 4, and 5, with enlargement of the foramen between C. 3 and 4 on the left side, and slight tipping of the cervical spine at this level.

Mr. Harvey Jackson removed at operation a large extradural and very vascular tumour at this level, which was lying on the left side, eroding the bodies of the adjacent vertebræ and pushing out into the foramen between C. 3 and 4. The paralysis rapidly improved, and subsequently Mr. Jackson explored the paravertebral region at this level, but found only a leash of large vessels entering the foramen and no paravertebral tumour.

Two years later the patient was re-admitted with a recurrence of his paralysis, and this time an ill-defined mass was palpable in the neck on the left side. An attempt was made to remove the spinal tumour, but the extreme vascularity made this difficult, and the patient developed respiratory paralysis and died.

At autopsy a highly vascular encapsulated tumour, lying extradurally on the left side, was found to pass through a greatly enlarged cervical foramen to form a paravertebral lobe, some 3 to 4 cm. in diameter, in the neck. The vertebral bodies were eroded by the tumour both within and from outside the spinal canal.

The histological appearance was that of a rapidly growing capillary angioma or hæmangio-endothelioma (*Fig.* 354).

Comment.—In this case there is clear evidence to show that the paravertebral tumour was only formed at a later stage, by extension of the primary extradural tumour through an eroded foramen into the neck.

4. Dumb-bell Ganglioneuromata.—The ganglioneuromata differ from the tumours already discussed, because of their tendency to arise early in life, sometimes before the vertebral column has fully developed. It seems probable that their dumb-bell shape is produced by the constriction of the developing vertebral column, rather than by extension through a foramen of a primary paravertebral tumour. This developmental theory was first suggested by Coenen (1927) when discussing the origin of an allegedly fibro-sarcomatous dumb-bell tumour, but the theory is more readily applicable to the ganglioneuromata, although it could also account for the dumb-bell tumours, of neurofibromatosis, such as *Case* 6.

The following case is an interesting example of a dumb-bell ganglioneuroma :—

FIG. 355.—Radiograph of the dumb-bell ganglioneuroma in *Case* 2. Note the enlarged foramen marked by an arrow, the scoliosis, and the semilunar opacity of the mediastinal tumour.

Case 2.—A man of 23 years complained of weakness of the legs and difficulty in micturition for three weeks. At the age of 5 years he had been a patient in another hospital with a similar complaint, and, on the basis of a radiographic opacity in the chest, had been diagnosed as a case of sarcoma of the spine, and discharged as inoperable. He had, however, recovered from his paralysis in a few years, and subsequently led a normal life until the onset of paralysis a second time.

On examination he had a gross dorsi-lumbar kyphoscoliosis with the major convexity to the left and the signs of a left-sided intra-thoracic tumour. There was a severe degree of spastic paraplegia with general impairment of sensation below the level of the 5th thoracic segment.

A radiograph (*Fig.* 355) showed a large semilunar tumour in the left upper mediastinum and a greatly enlarged foramen between the 4th and 5th thoracic vertebræ.

Thoracotomy was performed and a large lobulated tumour was exposed in the mediastinum, arising from the spine by several stalks. The largest lobe of the tumour was removed by cutting across its stalk, but the operation then had to be abandoned owing to the condition of the patient. He died shortly afterwards.

At autopsy (*Fig.* 356) several further lobes of the tumour were found lying along the course of the left paravertebral sympathetic chain, communicating through a number of enlarged intervertebral foramina with a lobulated extradural spinal tumour, which extended 3 or 4 in. along the spinal canal and had caused severe compression of the cord. The intraspinal part of the tumour was intimately related to several nerve-roots.

The most striking histological feature of the tumour was the presence in every section of a dense network of nerve-fibres, running in all directions and forming compact interlacing bundles of fibres (*Fig.* 357). Here and there were groups of ganglion cells, few in number as compared with the fibres, and many of them showing signs of degeneration. The framework of the tumour was composed of a delicate stroma of fibrillar connective tissue, surrounded by a dense capsule of fibrous tissue. Scattered in the stroma were small groups of lymphocytes.

By the Gros Bilchowsky silver impregnation method (*Fig.* 358) the majority of the ganglion cells were shown to be multipolar, although there were also some unipolar and bipolar cells. By the Loyez method it was impossible to demonstrate medullary sheaths to the nerve-fibres.

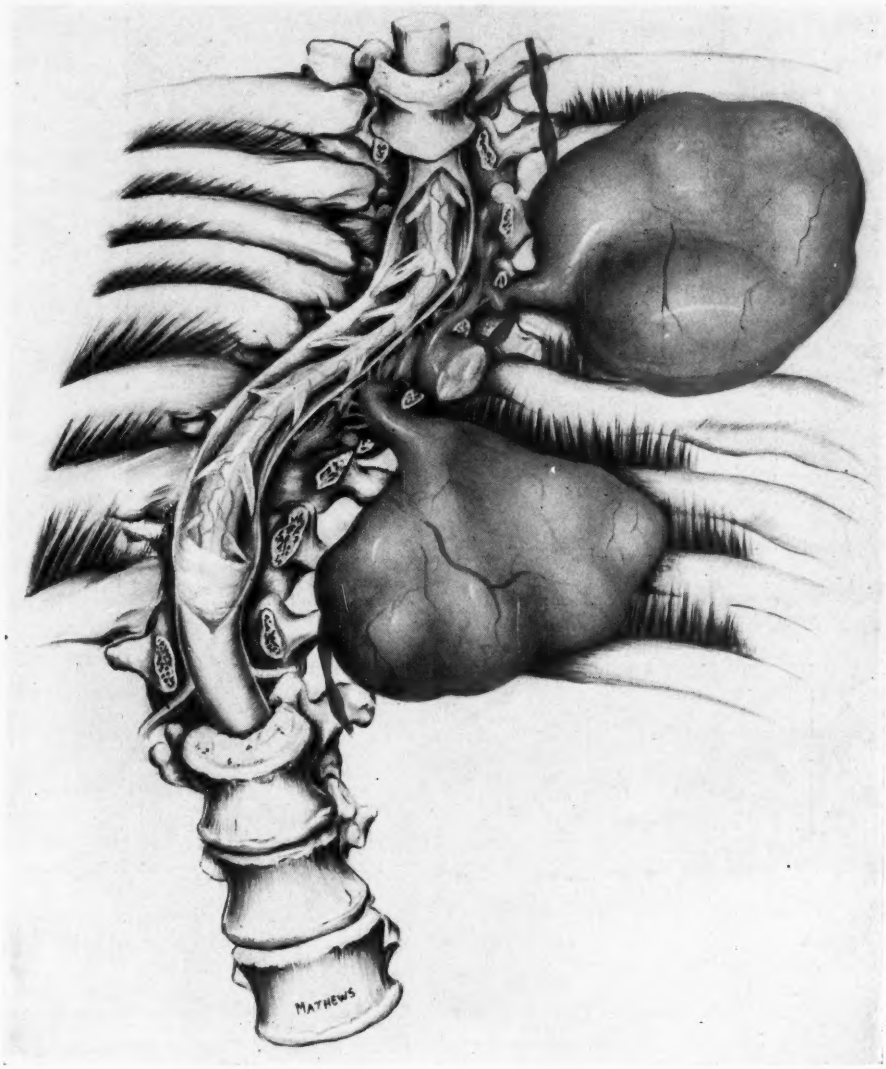


FIG. 356.—The post-mortem appearance of the spine in *Case* 2. The paravertebral tumours are arising from the left thoracic sympathetic chain and are connected by stalks through several enlarged foramina with a lobulated extradural tumour compressing the spinal cord and intimately associated with the spinal nerve-roots.

Comment.—This case is an example of a ganglioneuroma, which as Wahl (1914) and Dunn (1915) have shown arises from the sympathetic nervous system. In spite of its intimate association with several spinal nerve-roots, it is clear from the absence of medullated nerve-fibres in the sections of this tumour that it had no developmental association with these structures. It is also improbable in view of the early onset of paralysis and the subsequent slow growth of the tumour, that it was entirely intrathoracic in origin, and only later found

its way into the spinal canal. What is likely is that the tumour arose from the developing sympathetic elements during their migration from the ganglionic crest of the neural tube, the tumour only becoming dumb-bell in shape when the vertebral column had formed around it.

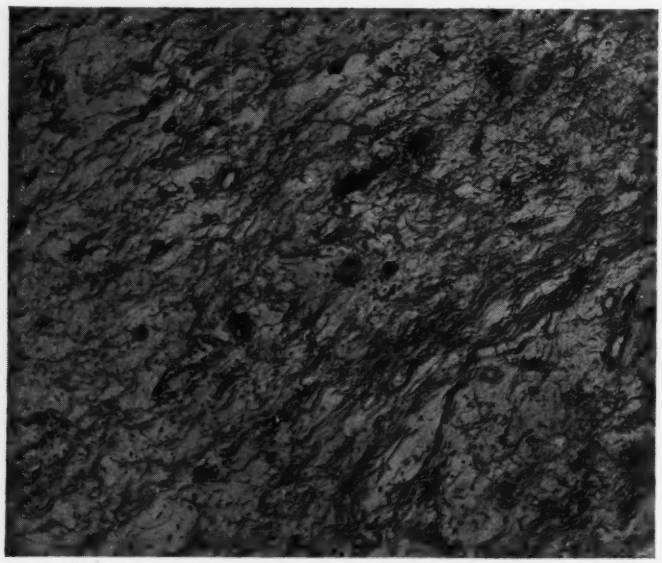


FIG. 357.—*Case* 2. Low-power view of a section of the ganglioneuroma showing interlacing bundles of nerve-fibres and groups of ganglion cells. (H. and E.) (× 64.)

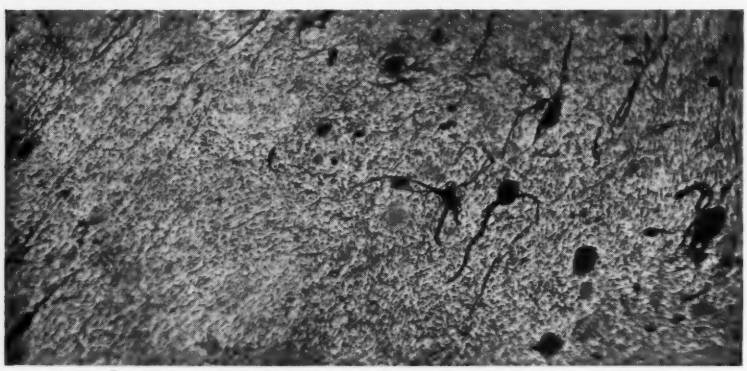


FIG. 358.—Section of the tumour in *Case* 2 stained by the Gros Bilchowsky silver impregnation method to show the ganglion cells. (× 56.)

CLINICAL FEATURES

The dumb-bell tumours present themselves in two main clinical forms: the patient may complain of a lump in the neck or in the back, with or without the exhibition of symptoms of paralysis; in the alternative form, no obvious lump is present, or it passes unnoticed, and the patient manifests the picture of spinal compression.

Any part of the spine may be involved, and, as Heuer (1929) has shown, the

location of these tumours does not differ obviously from that of the ordinary benign tumours of the spine.

In the neck, the lump appears in the posterior or anterior triangle and may displace the trachea or œsophagus, or extend into the thoracic inlet and cause symptoms of compression. It forms a smooth, firm tumour which, unlike the neurofibromata arising from the superficial sensory nerves, is fixed deeply in the vicinity of the spine, but may be difficult to distinguish from the solitary tumours of the brachial and cervical plexuses.

The only tumours in the thoracic region which are palpable are the posterior ones, lying deeply embedded in the erector spinæ muscles. The tumours of the mediastinum, especially those of the foraminal and paravertebral type, which do not reveal their presence by producing paralysis, are frequently silent and cause no symptoms for many years. Heuer (1929) found 9 examples of this silent type of tumour in 29 thoracic cases in the literature, while the remaining cases had only slight degrees of cough and dyspnœa, pain in the back, root pains, or symptoms of spinal compression. If the tumour is very large, there may be some bulging of the chest wall and the usual physical signs of a mediastinal tumour can be elicited.

Lower down in the lumbar region the lump may be palpable on the posterior abdominal wall, and in the sacral region it can be felt lying on the surface of the sacrum on rectal examination.

The following case is a typical example of the silent type of tumour which was only discovered during an examination for another disease :—

Case 3.—In the course of the investigation of a man of 38 years suffering from a chronic duodenal ulcer, a radiograph showed a large round opacity in the posterior right mediastinum, which in a lateral view was seen to lie opposite an enlarged 5th thoracic foramen (*Fig.* 359).

By direct questioning it was impossible to obtain any history referable to the tumour, but the patient requested its removal.

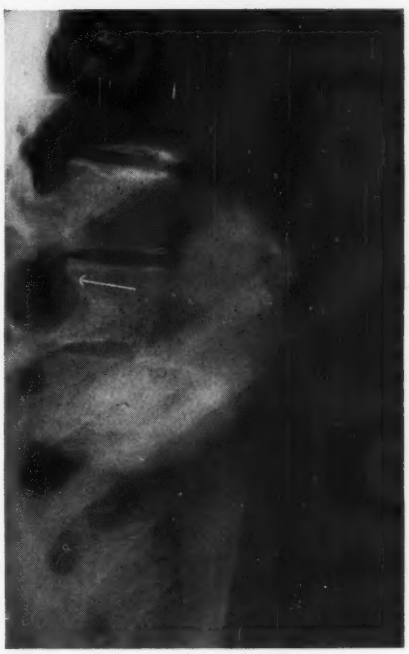


FIG. 359.—Radiograph of the spine in *Case* 3. Note the enlarged foramen, marked by an arrow, and the large mediastinal tumour overlying it.

The tumour was readily exposed by Mr. Julian Taylor by thoracotomy and removed together with a prolongation into the 5th thoracic foramen. This was made possible by enlarging the foramen slightly, and no damage was done to the dura or spinal cord.

Apart from a post-operative effusion which became infected and had to be drained, convalescence was uneventful and the patient is quite well five years later.

The tumour (*Fig.* 360) was encapsulated, semigelatinous in consistency, and weighed 250 g. The section showed it to be a neurofibroma.

Comment.—This is an example of the silent type of foraminal and paravertebral dumb-bell tumour, for it did not extend far enough into the spinal canal to produce cord compression. Tumours of this type are frequently mistaken for solitary mediastinal tumours, and commonly dealt with by thoracic surgeons rather than by neuro-surgeons.

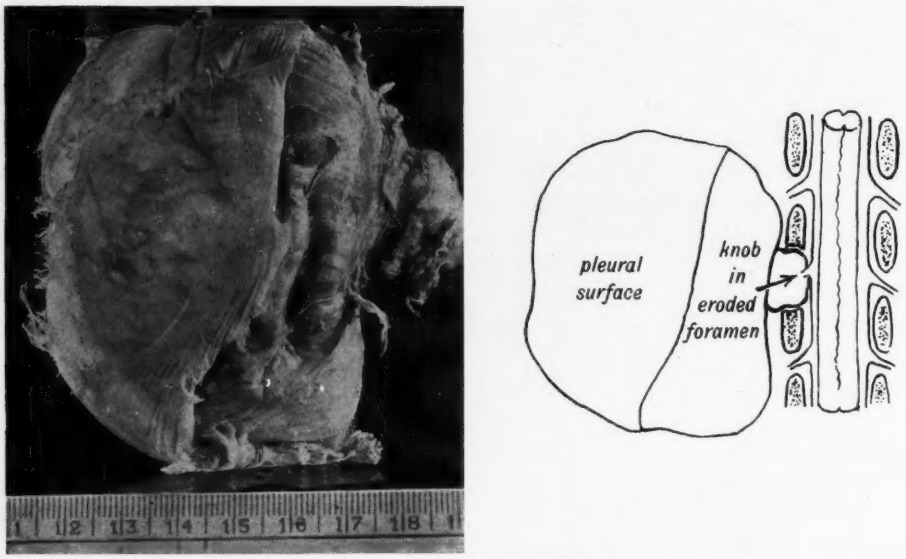


FIG. 360.—The tumour removed at operation in *Case* 3.

The intra- and extradural form of dumb-bell tumour, and those without a palpable paravertebral lobe, have no very characteristic clinical features which distinguish them from ordinary spinal tumours. When a paravertebral lobe is present, however, it is quite common for the spinal compression to improve temporarily, and later to relapse, as happened in *Case* 2. This is possibly due to the release of pressure within the spinal canal by the erosion of a foramen and the subsequent further growth of the spinal portion, with recurrent paralysis later.

Apart from the two main clinical forms of dumb-bell tumour, the diagnosis may first be made after an incomplete removal of one lobe. Thus a paravertebral tumour may have been removed from the neck or chest without detection of the intraspinous lobe, or an extradural tumour from the spinal canal leaving an intradural or paravertebral lobe untouched. In these cases the tumour continues to grow, and sooner or later a lump is detected adjacent to the spine; or spinal compression occurs. Cases of this type have been described by Elsberg (Case 40, 1925) and Naegeli (1924). When symptoms recur at the same level following the removal of an apparently intact neurofibroma, it is suggestive of a dumb-bell tumour part of which has been overlooked and has continued to grow. Perhaps the commonest error in practice is to remove an intradural neurofibroma without detection of a small extradural and foraminal extension, with temporary relief and subsequent recurrence of the paralysis. The following case is an example of this type :—

Case 4.—A woman of 49 years had been operated on five years previously for the removal of a small intradural neurofibroma on the right side, at the level of the 6th and 7th cervical vertebræ. She had recovered completely from her paralysis and returned to work for four years when her right arm and both legs began to get weak again, and she was admitted with a well-marked quadraplegia. All forms of sensation were moderately impaired below the level of the clavicles, and there was an area of anæsthesia in the right arm, corresponding to the 8th cervical root.

Owing to the previous laminectomy it was impossible to be certain of bony erosion in the radiographs of the spine.

At operation, Mr. Julian Taylor found a tiny intradural knob of tumour opposite the interval between the 6th and 7th cervical vertebræ, which was connected to a larger extradural tumour. On further dissection a process was seen passing through the foramen on the right side to join a small paravertebral lobe, the size of a walnut. By removing the roof of the foramen it was possible to excise the tumour in one piece, leaving the vertebral artery exposed but undamaged in front of the stalk.

The patient made a full recovery.

Comment.—This syndrome of recurrence of paralysis at the same level, after a period of relief following the removal of an intradural neurofibroma, is characteristic of a dumb-bell tumour, and should always suggest this diagnosis.

RADIOLOGICAL FEATURES

The frequent failure to diagnose the dumb-bell tumours, which is manifest in the published cases, is due partly to inadequate radiographic examination, but also because the possibility of a paravertebral extension is not considered and looked for in the radiographs.

The use of lipiodol in the localization of spinal tumours has led to a neglect of straightforward radiography, although as long ago as 1924 Carman and Davis aroused interest in the diagnosis and localization of spinal tumours by demonstrable bone erosion in radiographs of the spine. Since then, Adson and Camp, in a series of articles (Camp, 1933 and 1939 ; Adson and Camp, 1931 ; and Adson, Camp, and Shurgue, 1933), have confirmed the value of this method. In his latest analysis of a five-year series of spinal tumours at the Mayo Clinic, Camp found that 30·3 per cent showed bone changes.*

In order to understand the bone changes in the dumb-bell tumours, it is necessary to refer to the effect on the bone of other spinal tumours and of certain cerebral tumours.

Pressure erosion of the skull by intracranial tumours is common, in the form of enlargement of the sella turcica by pituitary adenomas, excavation of the internal auditory meatus by eighth-nerve neurofibromata, and widening of the optic canal by gliomas of the optic nerve. In all these cases the tumour lies in close relationship to the bone and is hampered in its growth by the surrounding bony compartment. In contrast, tumours lying deeper within the substance of the brain tend to displace the soft brain substance and cerebrospinal buffer, and to produce hydrocephalus, raised intracranial pressure, and general thinning of the skull bones, or separation of the sutures, rather than a localized erosion of the overlying bone. Sometimes, however, the pressure is raised disproportionately in one compartment of the skull and a localized thinning and bulging of this part of the skull results.

By comparison with the skull, the spinal canal is narrow and its displaceable soft contents small, with the result that local pressure changes are early, and there is less tendency to produce diffuse pressure effects. The tough dura, however, which encloses the spinal cord and is separated by a fatty space from the walls of

* It is important in all cases of suspected spinal tumour to obtain and scrutinize straight radiographs of the spine before carrying out myelography. For this purpose antero-posterior and right and left lateral pictures are adequate, except in the cervical region, where special oblique views, taken at an angle of 45° to the antero-posterior plane, are necessary to show the foramina on each side. When possible it is desirable to take stereoscopic views.

the canal, spreads out the pressure to some extent, and an intradural tumour produces a bulge of the theca over a distance of several centimetres. The first result of this compression is that the adjacent extradural fat atrophies and the widened dura then presses on the bony wall of a short length of the spinal canal. This is most readily seen as a flattening and loss of convexity of the inner surfaces of the vertebral pedicles in the antero-posterior radiograph (*Fig.* 361).*

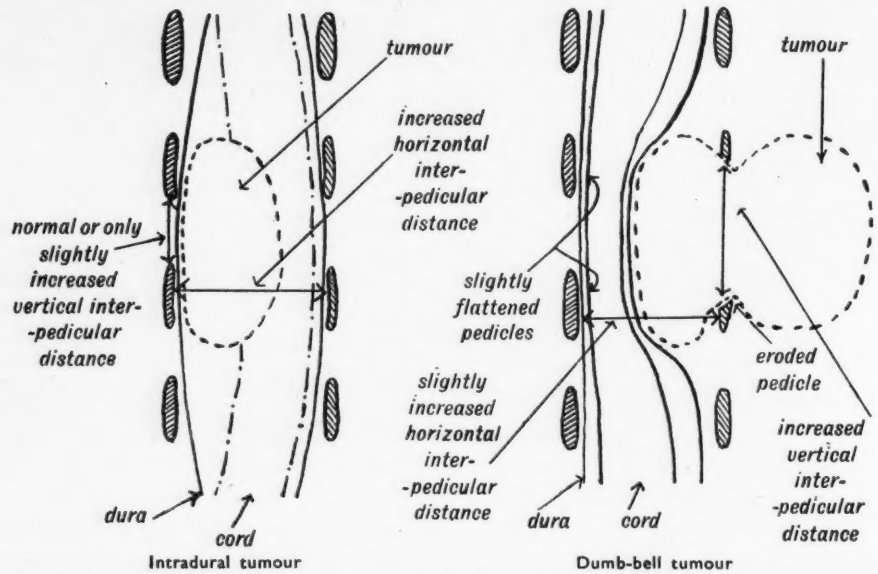


FIG. 361.—Diagrams to show the bone changes in simple spinal tumours and dumb-bell tumours.

Enlargement of foramina is unusual from the pressure of intradural tumours, but slight degrees of widening are occasionally found. In one such case (which I examined recently), the tumour, a large neurofibroma, did not project through the dura into the foramen, but had caused the dura to bulge into the foramen. This had thinned the vertebral pedicles not only on their inner surfaces, but at their adjacent upper and lower extremities, and had produced the appearance of slight enlargement of the foramen in the lateral film.

It is seldom possible to demonstrate thinning of the laminæ and scooping out of the vertebral bodies by the pressure of purely intradural tumours, except the rare giant neurofibromata of the lumbar and sacral region.

If the tumour is outside the dura, as in the extradural and dumb-bell tumours, the pressure effects on the bone are no longer spread out by the dura,

* The vertebral pedicles appear normally as oval shadows on each side of the vertebral body in the antero-posterior film and have a convex inner surface, although in the lower thoracic and lumbar regions they may appear almost flat. The thinning and further flattening due to the pressure of a spinal tumour can be observed, as a rule, without much difficulty.

Elsberg and Dyke (1934), however, believe that this erosion is not always obvious and that increases of 2 to 4 mm. in the horizontal interpedicular distance may be missed, unless these measurements are compared with the normal figures by plotting them on a standard graph.

Camp (1939) re-examined a series of spinal tumours by this method and found that only an additional 5 per cent of tumours can be detected by these measurements, while many more would be missed if the measurements alone were relied on, in preference to direct observation.

but are direct and local; and since most dumb-bell tumours are neurofibromata and lie in the course of a spinal nerve, the erosion is chiefly felt in a foramen, which is enlarged in all directions. In this case, the erosion is first observed at the adjacent upper and lower extremities of the pedicles bordering the foramen, and appears as an increased vertical interpedicular distance in the lateral films.

It is important to note that the pedicles are not always thinned from within, and in cases of dumb-bell tumour the horizontal interpedicular distance may remain normal. This is easy to understand in the foraminal and paravertebral type of tumour, or in those in which the pressure within the spinal canal is released by the erosion of a foramen and the bulging of the tumour into the chest or neck.

The bone erosion produced by extradural and dumb-bell tumours is also more extensive than that due to intradural tumours. One or more pedicles may disappear completely on one side, with or without thinning of the corresponding pedicle on the opposite side, excavation of the vertebral bodies on their posterior aspect, and erosion of the laminæ.

Once the tumour has escaped from the foramen or between the laminæ, a paravertebral opacity is usually produced. This shows as a rounded shadow in the radiograph, centred over an enlarged foramen and arising from the spine (*Figs.* 355, 359). The opacity coupled with the bone erosion may lead to confusion with such conditions as spinal caries, malignant disease of the spine, and thoracic aneurysm. The widespread destruction in the first two conditions, however, and the absence of foraminal enlargement, are usually characteristic enough to prevent confusion, while aneurysms erode the vertebral bodies from the anterior aspect, sparing the intervertebral discs and producing the so-called 'scalloped appearance'.

The paravertebral tumour as it grows erodes the spine from the outside, and in this way destruction of the transverse processes and vertebral spines is produced. The vertebral bodies may also be hollowed out from without, as well as from within the spinal canal, while rarely the excavation of the vertebral body is sufficient to cause it to collapse, just as in caries or malignant disease. As a result of the tilting and weakening of the ligaments, compensatory curves of the spine are formed and the affected part is buttressed. The following case is an example of this condition.

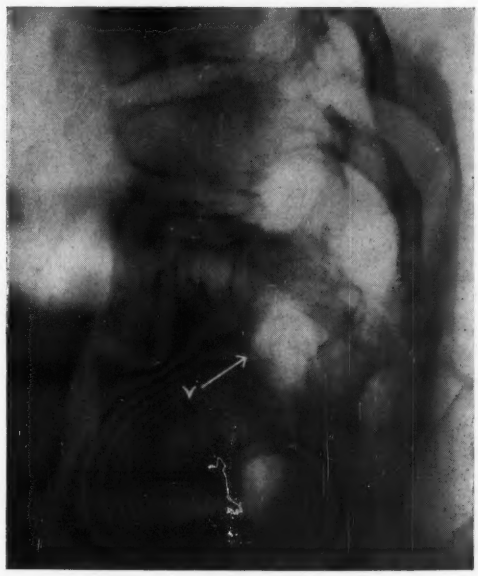


FIG. 362.—Radiograph of the spine in *Case* 5. Note the enlarged foramen (V), with surrounding reaction, the collapsed vertebra (C), and the angulation of the spine.

Case 5.—A woman of 50 years complained of increasing weakness and numbness of the legs and difficulty of micturition for three years. She had a severe degree of spastic paraplegia and loss of sensation in the distribution of the 5th lumbar and all the sacral segments.

Lumbar puncture showed a complete block, and the fluid was yellow and contained 3·8 per cent of protein.

The antero-posterior radiographs of the spine showed collapse of the 12th thoracic vertebral body, with extensive destruction of the pedicles of the 12th thoracic and 1st and 2nd lumbar vertebræ. The collapsed vertebra was buttressed by new-bone formation at the sides, and there was a moderate degree of kyphoscoliosis. In the lateral view the foramen between the 1st and 2nd lumbar vertebræ was greatly enlarged, but no paravertebral opacity was visible. (*Fig.* 362.)

Mr. Julian Taylor performed a laminectomy and successfully removed an intra- and extradural dumb-bell neurofibroma weighing 25 g. It had eroded the vertebral body extensively and projected into the foramen lower down on the left side, but without forming a large paravertebral lobe.

Comment.—The deformity of the spine in this case was undoubtedly due to the dumb-bell tumour, which had eroded the vertebral body and weakened the intervertebral ligaments. In view of the relative frequency of dumb-bell types of tumour in neurofibromatosis, it is interesting to inquire whether the spinal deformities so common in that disease have a similar cause.

SCOLIOSIS IN NEUROFIBROMATOSIS OF THE SPINE

Many authors have commented on the frequency of scoliosis in von Recklinghausen's neurofibromatosis. Weiss (1921) found it in 15 consecutive cases of the disease, and Engman stated in a subsequent discussion that it was present in every case which he had examined. Brooks and Lehman (1924), who have described the changes in the long bones in this disease, also noted the frequency of scoliosis; and although they were unable to examine the spine pathologically in any of their cases, suggested that the deformity might be due to neurofibromatosis of the vertebral periosteum.*

I have examined a number of cases of neurofibromatosis for evidence of this diffuse neurofibromatous infiltration of the periosteum, without positive result, and it is clear that this explanation will not suffice to explain the scoliosis.

Occasionally the deformity has an obvious possible cause, such as a large tumour of the arm or chest, as in the cases described by Antelme (1897) and Adrian (1902), but this is exceptional, and no such factor is present in the majority of cases.

The theory that the erosion of bone and the weakening of ligaments of the spine by multiple tumours of the spinal roots might explain the scoliosis of neurofibromatosis, was advanced by Preiser and Davenport (1918). This theory merits consideration, for there are undoubtedly cases in which multiple dumb-bell tumours are associated with the deformity. The following case is an example:—

Case 6.—A boy aged 2½ years was brought to hospital by his parents because of a swelling of the neck and inability to use the right arm, since the age of 6 months. On examination, the child was mentally deficient, the right arm was flaccid and practically powerless, and there was generalized subcutaneous thickening of the whole limb and the side of the chest and neck. Scattered over this area were irregular patches of brownish pigmentation, many of which were associated with thickened hairy patches of skin.

In the right side of the neck there was a large tumour which was fixed deeply, adjacent to the spine, and had displaced the trachea to the left, causing stridor. The surface of the

* Brooks and Lehman described the changes in the long bones as irregular overgrowth, cystic defects, decalcification and bending of the shaft, and either shortening or increase in length. They showed that the defects are due to tumours of the periosteum which produce a reactionary overgrowth of bone around them, and that in growing bones such tumours may interfere with the epiphysial cartilage, thus retarding the growth in length of the bone. The irregular overgrowth, on the other hand, is due to diffuse neurofibromatous infiltration of the periosteum, together with increased vasculature, resulting in a greater rate of growth and lengthening of the bone, much like the overgrowth of growing long bones in chronic osteomyelitis.

tumour was irregular and felt like a bunch of grapes, and there were other smaller oval swellings in the subcutaneous tissues of the arm with the clinical characteristics of neurofibromata. There was a well-marked Horner's syndrome on the right side.

The spine showed a cervical and upper dorsal kyphoscoliosis, with the main convexity to the left. Both legs were partially paralysed, and there was complete incontinence of urine and fæces.

A radiograph of the spine (*Fig.* 363) showed loss of alinement of the upper dorsal and lower cervical vertebræ, with extensive erosion of their bodies and foramina, and large paravertebral opacities on the right side of the neck, and on both sides of the thoracic inlet.

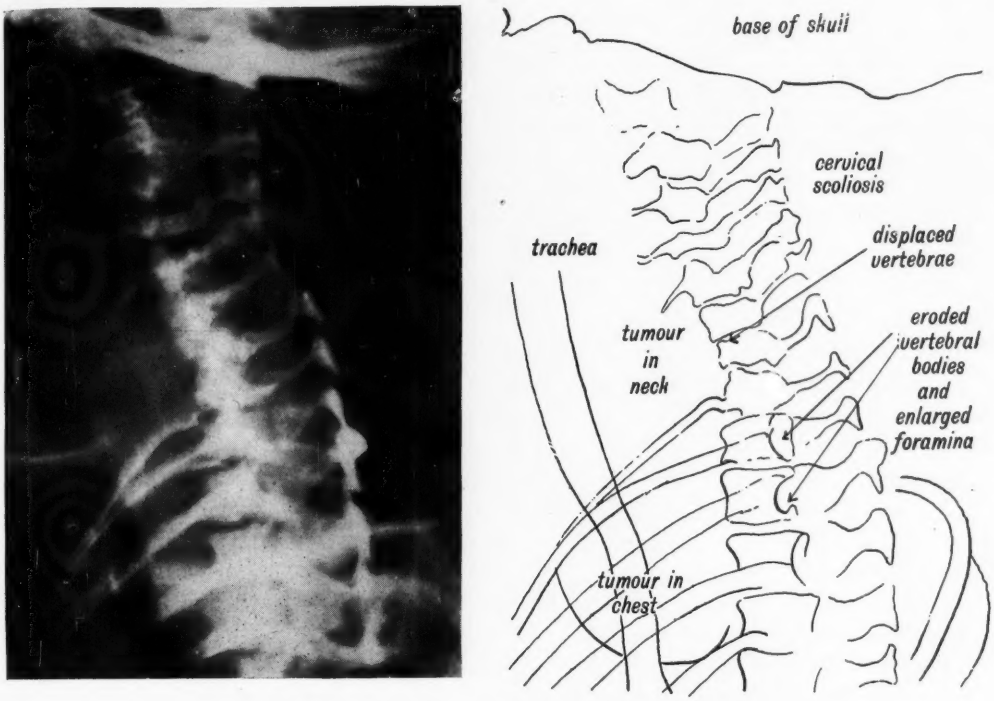


FIG. 363.—Radiograph of the spine in *Case* 6, showing the erosion of multiple dumb-bell tumours, and cervical kyphoscoliosis.

The diagnosis of neurofibromatosis was confirmed by biopsy of the tumour.

Comment.—In this case it is reasonable to suppose that the spinal deformity was due to the destruction caused by the extensive multiple dumb-bell tumours. Shortly after this case another example of severe kyphoscoliosis and neurofibromatosis came under observation and it was thought that a similar factor might be operative.

Case 7.—A girl aged 18 years complained of intractable bilateral girdle pains in the distribution of the 1st lumbar roots. She was a long-standing case of neurofibromatosis with generalized cutaneous pigmentation and multiple pedunculated fibromata, and had a severe dorsilumbar kyphoscoliosis. There were no physical signs in the nervous system.

A radiograph of the spine showed a gross deformity with much rotation, and a sharp lateral bend to the left at the level of the 1st and 2nd lumbar vertebræ, but owing to the distortion it was impossible to obtain a clear view of the foraminæ and pedicles. There was some general decalcification and a great deal of buttressing of the bone.

It was thought that the root pain might be due to the pressure of a tumour in the foramina, which were therefore explored directly on each side. Both were found to be free from tumour, and there was no evidence of neurofibromatous infiltration of the vertebral periosteum. She was subsequently treated in a plaster jacket.

Comment.—It is probable that the scoliosis in this case caused the root pain by squeezing the roots in the foramina. Mackenzie (1927) has described cases of severe congenital scoliosis complicated by root pain and paraplegia, directly due to the deformity, and Miller (1936) has recorded a case of neurofibromatosis with scoliosis in which paralysis of the legs was caused by the stretching of the spinal cord over the sharp angle of the spine.

It is evident, therefore, that scoliosis may occur in neurofibromatosis unassociated with dumb-bell tumours. The deformity is, in fact, rather characteristic in form, usually with a sharp angulation at some point in the thoracic or lumbar region, and as Pearce-Gould (1918) has shown, associated with general decalcification of the bone. The deformity is clearly distinct from that caused by erosion and displacement of the vertebræ by localized dumb-bell tumours.

The scoliosis of neurofibromatosis has certain points of similarity to the deformity found in syringomyelia, and it seems probable that its cause is to be found in a derangement of the tonic nervous control of the vertebral muscles. This might be caused by numerous tiny tumours of the posterior roots, as suggested by Parkes-Weber (1930), or by less obvious diffuse changes in the spinal cord or nerve-roots.

TREATMENT

For the purposes of treatment the dumb-bell tumours may be divided into two main types, those with paraplegia and those without.

In the presence of cord compression, laminectomy is the correct approach, for some of the smaller tumours can be removed completely by this route, and if a two-stage operation proves necessary, it is better to relieve the paralysis first. Information as to the size and position of the tumour is frequently provided by the extent of the bone erosion in the radiographs, and it may be unnecessary to use lipiodol for localization.

If a palpable tumour is present in the muscles of the back, it should be included in the incision, dissected out first, and its stalk traced down to a foramen or the laminæ. Otherwise the operation is an orthodox laminectomy until the dura is exposed. An extradural tumour is readily missed and should be looked for with care, especially in the vicinity of the foramina.

It is only necessary to open the dura if there is evidence of an intradural prolongation of the tumour. In this case, the intradural lobe is separated from the cord and the dura cut round the waist of the tumour, so that the intradural and extradural lobes are freed in one piece. The mobilization of the intradural tumour if it is lying anteriorly, is assisted by rotation of the spinal cord after dividing a dentate ligament, or by the division of posterior roots. As many as three consecutive posterior roots may be divided in the thoracic region without ill effects, but this should obviously be avoided in the cervical region.

At this point it is necessary to decide whether the operation can be concluded in one stage, or whether two stages are desirable. When there is only a small intraforaminal extension there is no difficulty in completing the operation at once, and this may also be possible even in the presence of a paravertebral lobe, providing that it is not too large and the general condition of the patient is good. Otherwise the stalk of the tumour is cut across as far laterally as possible, as it lies in the foramen.

In the one-stage operation the stalk is followed through the foramen by removing the bony roof piece by piece. Venous bleeding from the bone may be

troublesome in the presence of obstruction of the spinal canal and consequent congestion, but it can always be controlled by the use of free muscle-grafts.

In the thoracic region the paravertebral part of the tumour is exposed (*Fig.* 364) by removing the heads and necks of one or more ribs and the transverse processes. In order to do this it may be necessary to use a short counter incision at right

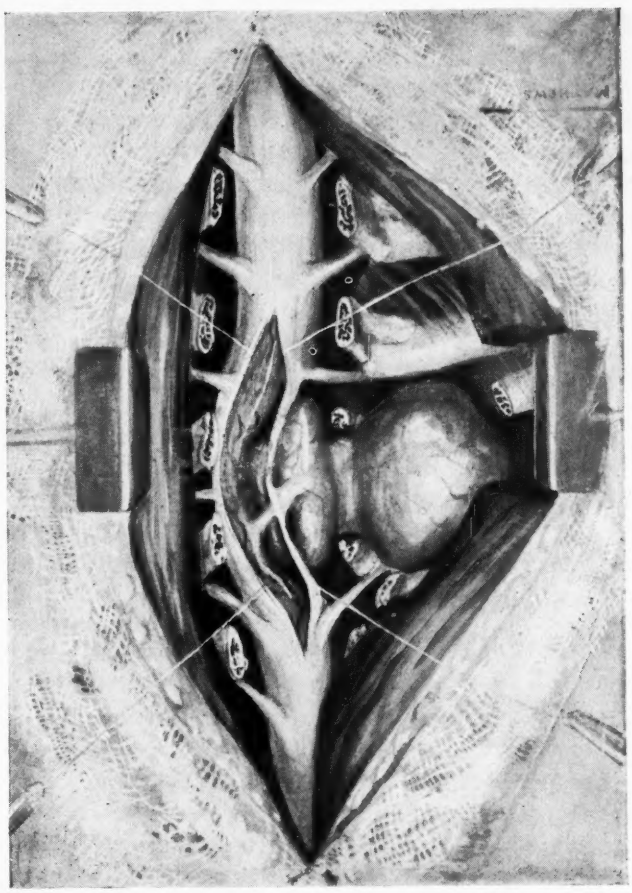


FIG. 364.—Diagram to show the operative approach to a thoracic dumb-bell tumour of the intra- and extradural and paravertebral type. The heads and necks of two ribs have been removed.

angles to the laminectomy incision, and to make use of the segmental nerve-supply of the erector spinæ muscles, and cut them partially across. In this case it is important to bring the muscle together again at the end of the operation, with strong mattress sutures, to ensure a good scar.

Once exposed, the tumour is readily dissected out of the mediastinum and can then be removed in one piece together with the intraspinal lobe. If the intraspinal manipulations are cramped, the tumour can be reduced in size by coagulating its substance, or it may be removed piecemeal.

In the cervical region it is important to avoid excessive removal of bone, or undue stretching of the muscles with paralysis of their nerve-supply, for fear of causing weakness of extension of the neck, or even a spontaneous dislocation. For

this reason a hemi-laminectomy is advisable when practicable, leaving as much bone as possible and unimpaired extensor muscles on one side at least, in order to be able to work further laterally on the other side. The removal of the foraminal stalk is undoubtedly more difficult in the cervical region, but the vertebral artery lies well anteriorly and will not be damaged by a careful removal of the roof of the foramen.

If the paravertebral lobe has been left to a second stage, it can be approached subsequently through an oblique incision in the neck behind the carotid sheath, or by costo-transversectomy or paravertebral lumbar exploration.

In the foraminal and paravertebral type of dumb-bell tumour which does not give rise to paralysis, it is unnecessary to do a laminectomy, and it is better to approach the tumour directly, as in the second stage of the previous operation. A costotransversectomy, however, is inadequate to deal with the giant intrathoracic tumours, and a thoracotomy is the best approach. In this case, the stalk is identified as it enters the foramen, and the foraminal prolongation dissected out. This will be easier if the foramen is first enlarged slightly by removal of bone around the edges.

It is unwise to attempt the removal of a large intraspinal prolongation by this direct route, for it is inevitably rather a blind procedure, and injury to the spinal cord may result. If the dura is damaged it should be closed, if necessary, with a free fascial patch, for a cerebrospinal fistula is otherwise liable to occur, as in the case described by Heurtaux (1899), and this is a dangerous sequel.

Sometimes in cases of neurofibromatosis, when multiple tumours are present and the condition of the patient is poor, it is impracticable to attempt a radical removal. In most cases, however, when a dumb-bell tumour has produced paralysis, it is worth removing enough of the tumour to relieve the cord compression.

SUMMARY

1. The term dumb-bell tumour of the spine is defined and the chief anatomical and pathological types are described. A full account of 6 cases is given to illustrate various aspects of their symptomatology and pathology.

2. In a series of 234 spinal tumours, 32 were dumb-bell tumours, of which 25 were solitary or multiple neurofibromata, 3 were meningiomata, 2 were hæmangio-endotheliomata, 1 was a ganglioneuroma, and 1 was an endothelial-celled sarcoma.

3. The dumb-bell shape is caused by a number of different factors, according to the pathological nature of the tumour. The dumb-bell meningiomata are confined to the intra- and extradural type and are produced by direct infiltration of the dura. All types of dumb-bell neurofibroma are formed, depending on the portion of the spinal root from which the tumour arises ; for example, an extradural and paravertebral tumour is formed when the site of origin is the segment of the nerve which passes through the foramen. Less commonly a primary extradural tumour worms its way out of the spinal canal through one or more foramina, or between two eroded laminæ, to form a secondary extraspinal lobe. The dumb-bell ganglio-neuromata are formed as the result of a disorder of a segment of the developing sympathetic system, during its migration from the ganglionic crest.

4. There are two main clinical types of dumb-bell tumour—those in which the syndrome is that of spinal-cord compression, with or without a paravertebral

tumour, and those in which a paravertebral tumour is detected, but no signs of paralysis are present.

In addition the recurrence of paralysis at the same level after the removal of a spinal neurofibroma, and the onset of spinal compression following the excision of a paravertebral tumour, are both suggestive of a dumb-bell tumour which has been overlooked.

5. Radiological examination provides valuable evidence of the nature and position of these tumours, in the form of enlargement of foramina and paravertebral opacities, and occasionally gross erosion of the vertebral bodies, with collapse and scoliosis.

6. Although in cases of neurofibromatosis, scoliosis may be associated with multiple dumb-bell tumours of the spine, the characteristic spinal deformity of that disease is a separate and distinct condition.

7. In the presence of spinal cord compression, the dumb-bell tumours should be approached first by laminectomy, in order that the paralysis may be relieved. If the tumour cannot be excised in one sitting through an extension of this operation, the paravertebral portion can be left behind to be dealt with directly later.

In the absence of paralysis it is possible to remove the whole tumour, using a paravertebral approach and enlarging a foramen.

I am indebted to the staff of University College Hospital and the National Hospital, Queen Square, who have kindly allowed me to make use of their cases; to Mr. Julian Taylor for his advice and criticism; and to Dr. J. G. Greenfield for permission to refer to his records.

REFERENCES

ADRIAN, C., *Wien. klin. Woch.*, 1902, **15**, 813.
ANTELME, F., *Bull. de la Soc. Méd. de l'Ile Maurice*, 1897, 491.
ANTONI, N. R. E., *Ueber Ruckenmarkstumoren und Neurofibrome*, 1920. München: J. F. Bergmann.
BING, R., and BIRCHER, E., *Deut. Zeits. f. Chir.*, 1909, **98**, 258.
BOERNER, E., *Ibid.*, 1902, **67**, 309.
BROOKS, B., and LEHMAN, E., *Surg., Gynecol. and Obst.*, 1924, **38**, 587.
BRUNS, L., *Handbuch der Nervenkrankheiten im Kindesalters' von Cramer, Bruns und Ziehen*, 1912, 301. Berlin: S. Karger.
BRUNSCHWEILER, H., *Corres. bl. f. Schweiz. Aerzte*, 1917, **47**, 449.
CAMP, J. D., *Proc. Staff. Meet. Mayo Clinic*, 1933, **8**, 239.
CAMP, J. D., *Amer. Jour. Roentgenol.*, 1939, **40**, 540.
CAMP, J. D., and ADSON, A. W., *Proc. Staff. Meet. Mayo Clinic*, 1931, **6**, 726.
CAMP, J. D., ADSON, A. W., and SHURGUE, J. J., *Amer. Jour. Cancer*, 1933, **17**, 348.
CARMAN, R. D., and DAVIS, K. S., *Radiology*, 1924, **3**, 185.
COENEN, H., *Deut. Zeits. f. Chir.*, 1927, **203**, 71.
COLLINS, J., and MARKS, H. E., *Jour. Nerv. and Ment. Dis.*, 1899, **26**, 36.
CUSHING, H., and WOLBACH, S. B., *Amer. Jour. Pathol.*, 1927, **3**, 203.
DANDY, W. E., *Ann. of Surg.*, 1925, **81**, 223.
DOWSE, T. S., *Brit. Med. Jour.*, 1874, **2**, 292.
DUBUJADOUX and CHEVALIER, *Arch. de Phys.*, 1883, **2**, 95.
DUNN, J. S., *Jour. Pathol. and Bacteriol.*, 1915, **19**, 456.
ELSBERG, C. A., *Tumors of the Spinal Cord*, 1925. New York: P. B. Hoeber.
ELSBERG, C. A., and DYKE, C. G., *Bull. Neurol. Inst. N.Y.*, 1933–4, **3**, 359.
FLATEAU, E., and SAWICKI, B., *Encéphale*, 1922, **17**, 617.
GULEKE, N., *Beitr. z. klin. Chir.*, 1916, **102**, 273.
GULEKE, N., *Arch. f. klin. Chir.*, 1922, **119**, 833.
GULEKE, N., *Zentralb. f. Chir.*, 1924, **51**, 50.
HEUER, G. J., *Arch. of Surg.*, 1929, **18**, 935.

HEURTAUX, N. (Abst.), *Zentralb. f. Chir.*, 1899, **26**, 1076.
LANNOIS, M., and DURAND, M., *Lyon méd.*, 1906, **107**, 1081.
LORETZ, W., *Virchows Arch.*, 1870, **49**, 435.
MALLORY, F. B., *Jour. Med. Research*, 1919, **41**, 349.
MACKENZIE, K. G., *Arch. of Surg.*, 1927, **15**, 222.
MILLER, A., *Ibid.*, 1936, **32**, 109.
NAEGELI, T., *Schweiz. med. Woch.*, 1924, **54**, 59.
NAFFZIGER, H. C., and BROWN, H. A., *Arch. of Neurol. and Psychiat.*, 1933, **29**, 561.
NONNE, M., *Deut. Zeits. f. Nervenheilk.*, 1910, **40**, 161.
PARKES-WEBER, F., *Quart. Jour. Med.*, 1930, **23**, 151.
PEARCE-GOULD, E., *Ibid.*, 1918, **11**, 221.
PENFIELD, W., *Surg., Gynecol and Obst.*, 1927, **45**, 178.
PREISER, S. A., and DAVENPORT, C. B., *Amer. Jour. Med. Sci.*, 1918, **156**, 507.
RAPP, L., *Bruns' Beitr. z. klin. Chir.*, 1913, **87**, 576.
SCHULTZE, F., *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, 1903, **12**, 153.
STOUT, A. P., *Jour. Amer. Med. Assoc.*, 1924, **82**, 1770.
WAHL, H. R., *Jour. Med. Research*, 1914, **30**, 205.
WEISS, R. S., *Arch. of Dermatol. and Syph.*, 1921, **3**, 150.
ZINN, H. R., and KOCH, M., *Charité Ann.*, 1900, **25**, 117.

A CASE OF PRIMARY CHONDROMA OF THE BRONCHUS

By MAURICE DAVIDSON
PHYSICIAN TO THE BROMPTON HOSPITAL

THE following case appears to be worthy of record, not only on account of the extreme rarity of the condition, but also because of the rather unusual symptomatology.

CASE REPORT

The patient, a man aged 66, was sent to me at the Brompton Hospital by Dr. J. F. D. Boyd, of Stapleford, Notts, on account of an intractable cough which had persisted for several years in spite of all attempts to relieve it. He stated that he first began to suffer from shortness of breath and wheezing about five years ago, and that eventually his symptoms became so severe that he was obliged to give up his work altogether. For the past three years the cough had been much worse, and for the last twelve months the dyspnœa had been increasing. The cough was accompanied by expectoration; the sputum, which varied in amount from 5 to 10 oz. daily, was never offensive; it was occasionally blood-stained, but there had never been any free hæmoptysis. Since January, 1940, he had lost a stone in weight. There was nothing in his past medical history referable to his chest.

When first he came to the Out-patient Department on August 28, 1940, he attracted attention by his cough, which was of a most distressing character, paroxysmal and explosive.

FIG. 365.—Radiograph (Aug. 28, 1940), showing triangular shadow at the right base due to collapse of the right lower lobe.

FIG. 366.—Bronchogram (Sept. 18, 1940), showing complete block of the right lower lobe bronchus: the branches of the left descending bronchus are normal in appearance.

The bouts of coughing sometimes continued for almost a minute at a time until the unfortunate man was cyanosed and momentarily unconscious. This state of affairs had continued, he said, for the last two or three years with increasing intensity, and Dr. Boyd had written to me: "Things are getting so bad that life for him is not worth living. . . . I send him to you in the hope that you may be able to give him some relief from this terrible coughing."

Physical examination gave little or no indication of the cause of the trouble. The chest was rigid and somewhat barrel-shaped, the percussion note hyper-resonant all over, and the respiratory murmur faint. Examination of the upper respiratory tract showed a healthy looking nasal mucosa; the larynx was normal, and all the accessory nasal sinuses appeared normal on transillumination.

A radiograph of the chest taken in the postero-anterior plane (*Fig.* 365) showed numerous calcareous deposits in the hilar regions: the appearances in the right lower zone suggested that there was some collapse of the right lower lobe, and it was thought that in all probability there was some dilatation of the basal bronchi, associated with obstruction of a main bronchus. The patient was accordingly admitted on September 9 for further investigation.

FIG. 367.—Microphotograph of tumour showing pure cartilaginous tissue.

For nine days after admission he was afebrile and exhibited no signs of toxæmia; the paroxysmal cough continued day and night. A considerable amount of frothy muco-purulent sputum (up to 10 oz. daily) was obtained by postural drainage, but expectoration was difficult, and little or no relief from the cough was obtained.

A bronchogram on September 18 (*Fig.* 366) showed a complete block of the right lower-lobe bronchus, the terminal concave shape strongly suggesting an intrabronchial polyp.

On September 20 a bronchoscopic examination was made by my colleague, Mr. Price Thomas. The larynx and carina appeared normal. In the right main descending bronchus was seen a smooth pinkish rounded tumour with a convex surface: it almost completely filled the lumen, but allowed a small amount of purulent secretion to ooze up from below. The middle lobe bronchus could not be identified. The tumour, which was pedunculated, with the pedicle attached laterally, was thought at the time to be in all probability an adenoma; the greater part of it was removed piecemeal, the bronchial obstruction being thus partially relieved. Three days later the patient, after an unusually severe paroxysm, coughed up a piece of tough white growth about twice the size of a cherry stone: this was followed by marked relief both from the cough and from the dyspnœa. On September 27 Mr. Price Thomas again examined him with the bronchoscope and removed the remaining pieces of growth; at the conclusion of this second operation the bronchus appeared clear.

The relief of the cough which succeeded this procedure was little short of dramatic. Postural drainage was continued, but expectoration, though it produced a considerable amount

of sputum, was no longer distressing, the secretion coming up quite easly. The patient was now able to sleep well, was conscious of free air entry into his chest, and was completely cured of the explosive paroxysms of coughing which had for so long rendered his life almost unbearable.

Microscopical sections of the growth showed it to be composed of purely cartilaginous tissue (*Fig.* 367). In no portion of the tumour removed or coughed up were there any signs of adenoma or any suggestion of malignancy. A final bronchogram on October 3 showed marked dilatation of the right basal bronchi (*Fig.* 368). Bronchoscopy in November showed no abnormality except dilatation of the lower-lobe bronchi.

FIG. 368.—Bronchogram (Oct. 3, 1940), showing bronchiectatic dilatation of the right lower lobe bronchi.

COMMENT

Chondromata of the lung are well known to thoracic surgeons, and according to Hickey and Simpson[3] are by far the most common of the benign pulmonary growths. Primary chondroma of the bronchus, on the other hand, appears to be an extremely rare phenomenon. I can find no record of it in the notes of the Brompton Hospital, and there is very little information to be found in the literature. According to Graham, Singer, and Ballon,[2] the first to diagnose the condition was von Eicken, who in 1907 removed a benign enchondroma from the main bronchus of a man aged 41. Blecher[1] gives an account of a large chondroma arising from the bronchus. The Jacksons,[4] in their work on bronchoscopy, mention ecchondromata and osteochondromata among a large variety of tumours of the tracheo-bronchial tree of which they have had experience; they consider them as benign tumours which are prone to develop malignancy. MacCallum[6] refers to chondromata arising in the trachea or bronchi as having a connexion with the cartilaginous rings, even though they may lie in the spaces between them; he notes, however, that in some cases large nodules have been found blocking the bronchus or extending into the lung tissue. Kaufmann[5] has a brief reference to chondromata of the bronchi and lungs, but evidently regards them as being usually

primary in the lung tissue or below the pleura, and having no relation to the bronchial cartilage. Siegert[8] published in 1892 a short account of intrabronchial chondromata, with references; a more recent account is given by Pfeiffer,[7] who deals with obstruction of the lower air-passages by benign tumours, including chondromata. I have so far been unable to trace any further references in the literature to this most unusual pathological condition.

The symptoms in this particular case were, in my experience, somewhat atypical of bronchial growths as a whole. The character of the cough, and especially its violence, were much more suggestive of a foreign body in the respiratory tract, movable and occasionally in contact with the larynx or at least with the upper part of the trachea. An alternative cause for cough of this type might have been a collection of pus in one or both maxillary antra which had been the seat of long-standing infection. Actually it must be presumed that this man's cough was due to irritation from pent-up secretion in the bronchiectatic portion of lung distal to the obstruction, since the latter was almost complete, though there was just enough room between the tumour and the bronchial wall to allow the passage of sputum when the patient was tipped. It is, however, difficult to understand why this should have resulted in cough of such persistent and distressing type: it will hardly be disputed, for example, that in bronchial carcinoma, in which all degrees of bronchial obstruction with secondary bronchiectasis may be seen, cough, though always present to a greater or less extent, never assumes the prominence or the severity which characterized this case.

My acknowledgements are due to the Resident Medical Officer of the Brompton Hospital, Dr. Foster Carter, for his kindness in making special prints of the radiographs, which were unusually difficult to reproduce, owing to lack of contrast between the opaque oil and the background. I have also to acknowledge the kindness of Dr. Smithers, of the Royal Cancer Hospital, who supplied me with the microphotograph of the histological section. To both of these professional colleagues I should like to express my gratitude for the considerable care and trouble they have taken over these illustrations.

REFERENCES

[1] BLECHER, S., "Ueber die klinische Bedeutung der Bronchialchondrosen", *Mitt. a. d Grenzgeb. d. Med. u. Chir.*, 1910, **21**, 837.

[2] GRAHAM, E. A., SINGER, J. J., and BALLON, H. C., *Surgical Diseases of the Chest*, 1935, 542. London: H. Kimpton.

[3] HICKEY, P. M., and SIMPSON, W. M., "Primary Chondroma of the Lung", *Acta radiol.*, 1926, **5**, 475.

[4] JACKSON, C., and JACKSON, C. L., *Bronchoscopy, Œsophagoscopy, and Gastroscopy*, 3rd ed., 1934, 277. Philadelphia and London: W. B. Saunders Co.

[5] KAUFMANN, E., *Lehrbuch der Path. Anat.* (Trans. by REIMANN, S., *Pathology for Students and Practitioners*, 1929, **1**, 469. London: H. K. Lewis & Co.)

[6] MACCALLUM, W. G., *Textbook of Pathology*, 6th ed., 1936, 1032. Philadelphia and London: W. B. Saunders Co.

[7] PFEIFFER, W., "Zur Klinik der Stenosen der tieferen Luftwege durch gutartige Tumoren (Chondrome und Fibrome)", *Arch. f. Ohren-, Nasen-, u. Kehlkopfheilk.*, 1929, **122**, 260.

[8] SIEGERT, F., "Ueber primäre Geschwülste der unteren Luftwege" (Part 2: "Intrabronchiales Chondrom"), *Virchows Arch.*, 1892, **119**, 419.

'SIMPLE' ULCERS OF THE CÆCUM, COLON, AND RECTUM

By DONALD BARLOW, London

Simple non-specific ulceration of the cæcum, colon, and rectum appears to be a clinical entity as definite as that in stomach and duodenum, and presents interesting features on account of its reported rarity, the difficulties presented in its diagnosis, and the uncertainty of its pathology.

As pointed out by Cameron (1939), the symptoms are so variable that, even when perforated, the condition has never been diagnosed with certainty previous to operation, except in a single rectal case where biopsy was possible.

The author has been able to collect 78 cases from the literature altogether, and, of these, 50 were located in the cæcum or ascending colon. In 22 of the 50 no diagnosis was recorded or arrived at, but in the remaining 28 it is mentioned that a pre-operative diagnosis of appendicitis in one form or another was erroneously made in 19 instances, i.e., in 68 per cent of cases where a diagnosis of any sort was hazarded.

Two such additional personal cases are here recorded in which the same error was made, and it is clear that whilst simple ulceration of the colon may present itself in various obscure ways, ulcers in the right side of the large bowel—the commonest site—have a strong tendency to present a picture indistinguishable as yet from appendicitis.

CASE REPORTS

Case 1.—

History.—Mrs. N. L., housewife, aged 58, was admitted to the Southend-on-Sea General Hospital on October 29, 1937, complaining of acute central abdominal pain which had started twenty-four hours earlier and had been accompanied by vomiting.

She mentioned that one month previously she had swallowed a herring bone, but had brought it up immediately. One week before onset of the acute symptoms she had noticed a vague aching feeling around the umbilicus and in the right iliac fossa and had derived comfort by drawing up the right leg. She also suffered from flatulence, but had not been particularly constipated.

The menstrual periods had ceased fifteen years before and there were no urinary symptoms.

The patient had taken her own temperature before being brought to hospital and had found it to be 100° F. On admission the temperature was 99·4° F. and the pulse 104 per minute.

There was no history of previous illness.

On Examination.—The patient was well nourished and her general condition good. The tongue was clean.

There was marked tenderness in the right iliac fossa associated with very definite rigidity in the right lower quadrant. No mass was palpable. Nothing abnormal was discovered on rectal examination.

No abnormality was found in the urine and the chest was clear.

A pre-operative diagnosis of acute appendicitis was made.

Operation.—On October 29 (the day of admission) the abdomen was opened through a right paramedian incision, the patient having been given a general nitrous-oxide–oxygen–ether anæsthetic. The appendix was normal. The ascending colon in its lower part appeared to be a little œdematous and this was much more obvious towards its posterior aspect. The

area of œdema extended from within 2 cm. of the ileocæcal valve upwards for 8 cm. On palpation, the posterior aspect of the ascending colon was firm, indurated, and firmly adherent to the posterior abdominal wall. Some 5 cm. above the ileocæcal valve it was almost cartilaginous in consistency, and on palpating through the bowel, an ulcer crater which admitted the tip of the index finger could be felt. No glands were palpable in the mesentery.

FIG. 369.—*Case* 1. Drawing from specimen removed at operation.

A diagnosis of carcinoma of the ascending colon was now made and a radical operation was performed without particular difficulty.

The cæcum and whole ascending colon were mobilized inwards by dividing the peritoneum laterally. In the region of the ulcer, stripping was rather difficult, but the base of the ulcer had not quite perforated the bowel wall. The specimen removed consisted of the lower 3 inches of the ileum, the cæcum, appendix, ascending colon, and first 4 inches of the transverse colon. An ileo-transverse colostomy was established by lateral anastomosis.

PROGRESS.—On the thirteenth day after operation, the patient had a small pulmonary embolism in the right lower lobe and signs of consolidation and crepitations persisted for several days. Apart from this, her recovery was uneventful.

Under the follow-up scheme, she was seen on December 9, 1938, and again in March, 1940. On each occasion she expressed herself as being perfectly well and free from any symptoms. Nothing abnormal was found either in the abdomen or on pelvic examination.

SPECIMEN (*Fig.* 369).—The appendix was quite normal but arose from the terminal part

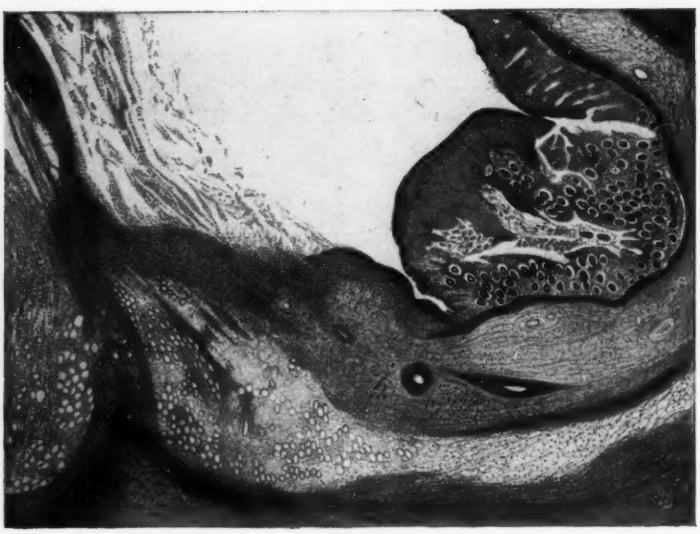


FIG. 370.—*Case* 1. Drawing of microscopical study of edge of ulcer. (× 12.)

of the cæcum. The ileum and cæcum were also normal. The area of œdema has been described, but the mesentery was also involved in this process. On opening the specimen, the edge of the ulcer was inadvertently cut across. The ulcer itself was deep and funnel-shaped and at its inner surface measured 1¼ cm. across. It was 2 cm. deep. It had passed right through the mucous and muscular coats and was on the point of perforating. The lower border of the ulcer was 5 cm. from the ileocæcal valve and on the mucous surface there was a markedly œdematous area surrounding the crater. The latter was somewhat sloughy, and red-black in colour. On palpating the œdematous ring, it was found to be surprisingly hard, as though the ulcer was of some standing and suddenly the process had become active again.

There was no evidence of malignancy and there was a strong resemblance to an ordinary gastric ulcer, except for its funnel shape.

Microscopical (*Fig.* 370).—The edge and base of the ulcer were perfectly simple in nature. The surrounding mucosa was œdematous and infiltrated with inflammatory cells, both leucocytes and lymphocytes. The base of the ulcer was sloughy and appeared to be undergoing a process of active necrosis, the muscular coats having been completely destroyed. No evidence of malignancy, syphilis, or tubercle could be demonstrated. Amongst the inflammatory cells in the base a good number of fat cells were embedded. At the edges there was some fibrin and many fibroblasts.

With reference to the vessels in this section, those in the acutely inflamed area showed an acute inflammation of the wall as part of the general process, and, with this, occasional thrombosis; but there was no 'endarteritis' as the term is usually used.

Case 2.—

HISTORY.—Mr. W. S., commercial traveller, aged 55, was first seen in the Out-patient Department of the Southend-on-Sea General Hospital on August 11, 1939, complaining of persistent epigastric pain for one month, which he said was made worse by food so that he was afraid to eat and had lost weight rapidly, having taken almost nothing for ten days. Three years ago he had attended the hospital with similar pain and a radiograph was said to have suggested the presence of a small gastric ulcer. With the present attack there had been vomiting and retching. The bowels had been constipated for one month, but previously had been regular.

ON EXAMINATION.—The patient was fairly well nourished, and apart from some definite epigastric tenderness and a small reducible para-umbilical hernia there were no other abnormal abdominal signs. Rectal examination was negative. There was a small soft gland palpable in the left supraclavicular fossa.

A further X-ray opaque meal carried out on August 12, 1939, showed "an extremely rapid emptying of the stomach. Barium poured through, suggesting that the pylorus was patent and the whole of the pyloric end rigid, due probably to invasion by new growth."

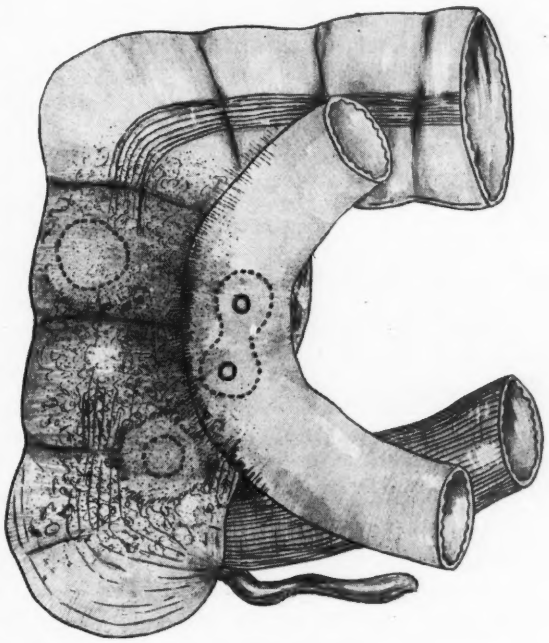


FIG. 371.—*Case* 2. Sketch of condition at operation.

A differential blood-count was normal, however, and a fractional test-meal showed marked hyperchlorhydria. The temperature fluctuated from 99° to 100° F. Pulse-rate about 80 per minute. At no time, up to this stage, had there been any tenderness in the right iliac fossa.

FIRST OPERATION (Aug. 18, 1939).—Because of the doubt as to the diagnosis of carcinoma owing to the hyperchlorhydria, the abdomen was opened under nitrous-oxide–oxygen–ether, through a left upper paramedian incision designed to include a repair of the ventral hernia. No carcinoma of the stomach was present, but there was a very small simple ulcer on the posterior wall of the duodenum. It was considered probable that this would react well to proper medical treatment and the abdomen was therefore closed with repair of the hernia, without any operative interference to the stomach.

PROGRESS.—Seven days after the operation, however, the abdomen became greatly distended and hyper-resonant. The distension was uniform, but there was now very marked tenderness in the right iliac fossa and the patient became dehydrated and very ill. He vomited only once or twice. The temperature was still 99° F. and the pulse 90 to 100 per minute. Rectal examination revealed marked tenderness on the right side.

A diagnosis of acute perforated appendicitis with general peritonitis associated with gas in the peritoneal cavity was now made.

SECOND OPERATION (Aug. 25, 1939).—Spinal anæsthetic—Metycaine 0·8 c.c. with pre-operative atropine $\frac{1}{75}$ gr. and omnopon $\frac{1}{3}$ gr. Abdomen opened through lower right para-median incision and much free gas escaped. There was also some faintly turbid free fluid, and the whole cæcum including the lower 4 in. of the ascending colon were acutely inflamed, very thin, and injected. The surface was granular. Adhering by lymph to the inner side of the ascending colon was a loop of small intestine, which, when separated, revealed two perforating ulcers on the inner side of the colon. These were close together and about $1\frac{1}{2}$ in. above the ileocæcal valve. On the anterior wall of the colon were two other ulcers each surrounded by an area of induration as if they were of some standing. The lower was just above the ileocæcal valve and the second and larger ulcer $2\frac{1}{2}$ in. higher up. The appendix was normal and was not removed (*Fig.* 371).

The perforations were sutured after packing off the rest of the peritoneal cavity. In view of the presence of the other ulcers and the inflamed and thinned state of the colon, the whole of the anterior surface of the cæcum and ascending colon were exteriorized and sutured to the skin by mobilizing the latter inwards. The rest of the abdomen was closed with separate stab drainage into the pelvis.

PROGRESS.—The following day the cæcum was opened with a diathermy, and from that time the patient's condition steadily improved apart from a small secondary hæmorrhage for which a blood transfusion was given. The cæcostomy continued to function well and all symptoms disappeared. He was discharged to the Out-patient Department on October 19, 1939.

On November 7, 1939, he attended complaining of a tender swelling in the abdomen to the left of the cæcostomy and was re-admitted at once.

Examination revealed a large abscess extending right across the abdomen from the left costal margin to the right iliac fossa.

A diagnosis of large intraperitoneal abscess, limited by omentum, was made.

THIRD OPERATION (November 7, 1939).—The abscess was opened under nitrous-oxide and a great deal of pus evacuated, followed the next day by thin fæcal matter and it was evident that he now had a small-intestine fistula.

FURTHER PROGRESS.—This finally healed well after discharging for a month. Since then, the abdominal wounds have remained soundly healed and the cæcostomy was successfully closed by a fourth operation on March 15, 1940. He is now quite free from symptoms and has put on weight.

DISCUSSION

A detailed study of all recorded cases of large-bowel ulceration leaves the impression that too much stress has been laid on ulceration in the cæcum and ascending colon. Whilst there is no doubt that these are the commonest sites, the disease frequently affects other parts of the colon, particularly the sigmoid (16 per cent), and reference to *Fig.* 372 will show the whole percentage incidence.

Probably the most striking feature of this unhappy disease is that it has never been diagnosed with certainty before operation. So much was stressed by Cameron,

but what is even more important is that so far as treatment is concerned, in the case of ulcers in the cæcum and ascending colon there was usually sufficient indication to open the abdomen, whereas in the case of ulcers in other parts, operation was resorted to in only 50 per cent of the cases and death occurred in every one of the rest. Even those operated upon had a high mortality (*see below*).

Pathology.—The pathological similarity between colonic and cæcal ulcers on the one hand and gastric and duodenal ulcers on the other, is striking, and the aetiology of all types is obscure. Wilkie considered that simple ulcer of the cæcal colon is a pathological entity, but there is no doubt that similar ulcers occur in all parts of the colon and occasionally in the rectum and small intestine. It is probable that those on the right side of the colon preponderate to an even greater extent than is suggested. Of the 28 cases not situated in the cæcum and ascending colon, 7 were insufficiently recorded but were probably not true examples of simple ulcer. Omitting these, 10 of the remaining 21 occurred in the sigmoid colon. It would therefore seem to be established that ulcers of similar type occur in stomach, cæcum, and ascending and sigmoid colon—three sites where there is relative stasis.

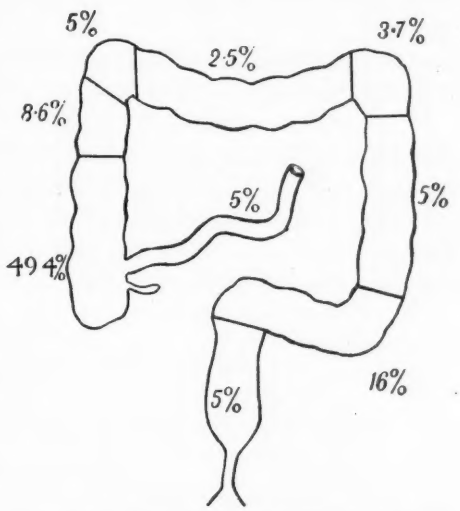


FIG. 372.—The percentage incidence of simple ulceration in the colon. Note the preponderance in the cæcum and ascending colon

Attempts have been made to draw the analogy between cæcal and gastric ulceration still closer by comparing the blood-supply of the parts and the *p*H reaction of the bowel contents. A careful study of injected cleared specimens, however, did not demonstrate any particular area as having a specially poor blood-supply or a supply by end-arteries, and the *p*H reaction of the cæcal and sigmoid contents can hardly be compared to that of the stomach. Specimens tested from cæcostomies were neutral or very faintly acid in reaction.

On the other hand, colon and gastric ulceration have much in common microscopically except that the former tends to be more acute and funnel-shaped or perforating in type, and clinically the patients endure far less pain than the latter, or may be entirely symptomless until they are on the point of perforation or have actually perforated.

Coincident gastric or duodenal ulceration was recorded in 4 per cent of cases. In the remainder, however, there was rarely any mention of the stomach having been examined and the coexistence of chronic ulceration may be higher than is at present thought.

The concrete facts seem to be that the great majority of ulcers were in sites of relative stasis, and reports stress the funnel-shaped perforating type with frequent erosion of muscle. The edge is often hard and relatively chronic, but the base very active, suggesting a lesion of slow onset suddenly become acute. This was well shown in *Case* 1. A careful microscopical study failed to show any 'end-arteritis' in the sense that there was an intimal proliferation and obliteration of

the lumen by a gradual process of thickening of the wall. Along with the general inflammation, there was acute inflammation of vessel walls, with occasional consequent thrombosis. It could not have been said from that specimen that thrombosis, embolism, or endarteritis was causative.

Unlike cases of gastric and duodenal ulcer, most patients were well nourished and worry had had no influence. The age incidence was highest between 25 and 50 years, but there were a few as young as 18 and as old as 80. Male cases were more frequent than female, especially where the left side of the colon was involved. Of the cæcal and ascending colon group 60 per cent were male, but in the descending and sigmoid colon group nearly 80 per cent were of that sex.

Diagnosis (*Table I*).—These two facts stand out: (1) No case was correctly diagnosed prior to operation or post-mortem. (2) No case not operated upon survived.

It is therefore evident that whatever operative measures seem indicated, it is essential to open the abdomen as early as possible.

An analysis of the records show that 66 per cent of ulcers in the right side of the colon and 81 per cent of those in the left were already perforated when first seen, and that nearly half the former had *free gas* either intra- or extraperitoneally. The majority of these had had very little in the way of symptoms before perforating, except constipation and vague pains. A further 10 per cent of sigmoid ulcers were reported as on the point of perforating and most had acute localized pain.

Table I.—Pre-operative Diagnosis in 52 Cases of Simple Ulcer of Cæcum and Ascending Colon (including 2 Personal Cases)

	No. of Cases	*Percentage*
Correct pre-operative diagnosis	0	0
No diagnosis made	20	38·6
Appendicitis in one form or another	19	36·6
'Appendicitis' 7		
Acute appendicitis 7		
Chronic appendicitis 3		
Appendix abscess 2		
Carcinoma of cæcum or colon	4	7·7
In addition, at operation 4 cases with a pre-operative diagnosis of appendicitis and one with no original diagnosis were thought to be malignant		
Peritonitis. ? Cause	2	3·8
Cæcal ulcer?	1	1·9
Simple stenosis of ascending colon and duodenal ulcer	1	1·9
Acute dilatation of stomach	1	1·9
Strangulated femoral hernia	1	1·9
Incomplete obstruction	1	1·9
Chronic invagination	1	1·9
Acute abdominal condition, but no definite diagnosis	1	1·9
Total	52	

So far as opening the abdomen is concerned, it seems that there was ample indication for this in 66 per cent of cæcal and ascending colon ulcers and in 91 per cent of those in the sigmoid. That, in fact, many were not opened and the mortality was consequently very high must be attributed to the fact that a good many case records go back more than thirty years.

The chief difficulty was with the remainder of the right-sided cases and with a few occurring in odd situations. No pathognomonic signs can, unfortunately,

be given, but where pain of unexplained origin is present in the right side of the abdomen the possibility of simple non-specific ulcer must be considered and may perhaps be confirmed by *barium-air contrast radiography*. It is suggested that the latter may be of real use in difficult cases, but wherever there is doubt the abdomen must in any event be opened because of the liability to perforate.

Treatment.—From the above, it follows that this must always be *operative*. The type of operation depends upon the site, virulence, and stage of the disease and the state of the bowel wall.

The measures adopted in the past have been: (1) Simple drainage—all died. (2) Oversewing of ulcer with drainage—of 9 cases, 7 survived. (3) Local excision with drainage—of 5 cases, 4 survived. (4) Resection of whole area with anastomosis—of 11 cases, 10 survived. (5) Exteriorization and opening of diseased area—of 3 cases, 2 survived.

Every case must be judged separately, because the lesion varies from a hard indurated ulcer to one which is perforated, with perhaps peritonitis and a gangrenous area of bowel.

Simple drainage is not enough, but the writer's feeling is that where the ulcer has not perforated, a resection with lateral anastomosis is the best procedure. Where perforation has occurred this is probably too dangerous, and oversewing of the ulcer or exteriorization, with drainage of the pelvis, is indicated.

Local excision and suture of the ulcer with drainage of the pelvis also seems to have met with some success even where general peritonitis was present.

SUMMARY

Two personal cases of typical simple non-specific ulceration of the cæcum with recovery are recorded.

The question of the pathology is examined.

An effort has been made to clarify the position with regard to diagnosis and to indicate lines of treatment, which should always be operative.

Thanks are due to Dr. A. J. E. Cave, of the Royal College of Surgeons, and to Dr. L. T. Bond, of the Southend General Hospital, for assistance with the pathological work.

BIBLIOGRAPHY

CAMERON, J. R., *Brit. Jour. Surg.*, 1939, **26**, 526.
(With the exception of those given below, a complete bibliography of the subject may be found in the above paper.)
KERR, R. A., *Lancet*, 1935, **2**, 550.
LINDQVIST, S., *Acta chir. Scand.*, 1922–3, **55**, 142.

A CASE OF ARTERIOVENOUS ANEURYSM

By SOL. M. COHEN and C. A. R. SCHULENBURG
SOUTHERN HOSPITAL, DARTFORD

William Hunter, in 1761, clearly described arteriovenous aneurysm.[1] In the war of 1914–8 numerous cases were recorded.[2] Sir George Makins, in his review,[3] after the war, of the injuries of the blood-vessels, stated that aneurysmal varices, of which this case is an example, and which are due to war wounds, are usually overlooked at the early stage. The serious cardiac disturbances that may follow from the alterations in circulation are now well accepted, due largely to the work of Reid,[4] Holman,[5] Matas,[6] and Pemberton and Waugh.[7]

CASE REPORT

The following case is of special interest as it demonstrates in striking manner the pathological anatomy of the local lesion :—

History.—Private W. B., aged 21 years, was wounded in Belgium by a machine-gun bullet on May 22, 1940. The bullet passed through his left thigh, leaving small entrance and exit wounds. For twenty-four hours he lay on the field and readily controlled some "moderate" hæmorrhage by himself, applying his field dressings. Four days later, he was anæsthetized and, as far as can be ascertained, vaseline packs were inserted into both wounds for drainage. On May 29 he was evacuated from Dunkirk and admitted to a hospital in Lancashire. He was kept in bed until the end of June when the wounds had soundly healed, apparently with very minor sepsis. As soon as he commenced to walk, the left leg began to swell and he was conscious of a peculiar "purring" feeling in the thigh.

On Admission.—On September 6 he was admitted into this hospital and the following features were noted : There was a scar on the outer side of the left thigh and another on the inner side over the apex of Scarpa's triangle. No tumour was visible, but a swelling could be felt over the line of the femoral vessels in Hunter's canal and there was a marked palpable thrill. A very loud continuous bruit could be heard over it, the bruit being intensified with systole and conducted downwards to below the knee and upwards to Poupart's ligament. The left leg was obviously larger than the right and the circumference of the calf was 1½ in. greater. No varicose veins could be seen. Compression of the femoral artery against the pubic ramus caused the thrill and bruit to disappear. There were no heart murmurs and a radiological examination confirmed the clinical finding that it was not enlarged. The pulse-rate was 76–80 at rest, and his blood-pressure 130/80 mm.

Operation (Mr. W. H. Ogilvie).—On September 17 (four months after the injury) under evipan and gas and oxygen anæsthesia a long incision was made in the line of the artery. No tourniquet was used. After incising the roof of Hunter's canal the aneurysmal dilatation could be made out. The saphenous nerve was isolated and retracted. The vein and artery were then defined for about 2 in. above and below the tumour. Quadruple ligature, using No. 4 silk, was then performed, and the whole mass carefully dissected out and removed. The blood-pressure, which was 130/80 before ligature, changed to 110/90 immediately after tying the artery.

Progress.—The leg remained warm after the operation, and the dorsalis pedis artery was felt pulsating on September 21, four days after operation. The patient was kept in bed for twenty-one days after operation. On being allowed out of bed, it was noted that there was a slight amount of swelling of the left ankle, which disappeared after a few days, and the limb became normal in appearance. He was discharged 'fit' on November 11.

PATHOLOGICAL APPEARANCES.—The specimen (*Fig.* 373) illustrates: (1) The wall of the vein becoming 'arterialized'. (2) The increase of the vein lumen. This is not as marked as in most cases of the condition. (3) The diminution of the arterial lumen below the anastomosis. (4) A small arterial aneurysm present opposite the anastomosis.

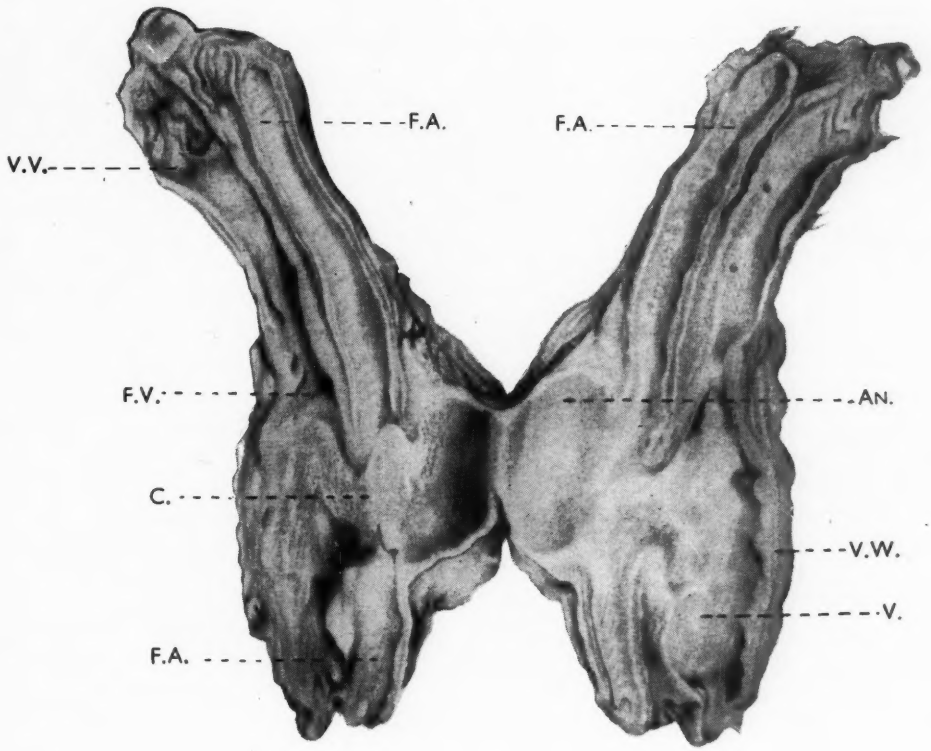


FIG. 373.—Illustration of the specimen, longitudinally split. AN., Aneurysmal sac on the course of the femoral artery; C, Communication between the femoral artery and the vein; F.A., Femoral artery; V., Vein dilated to form a spindle-shaped sacculation; V.V., Valve on the course of the vein—the vein below this point is normal; V.W., Thickened wall of the vein in the sacculated region; F.V., Femoral vein.

Comment.—

1. The hæmorrhage at the time of injury was not severe.
2. No secondary changes were seen in the heart four months after the injury.
3. There was a fall in systolic pressure and a rise in diastolic pressure after ligature of the artery.
4. The limb completely returned to the normal. This confirms the opinion of Makins and Pemberton and Waugh, that the optimum time for operation is between the third and sixth months after injury. This interval permits of the establishment of a good collateral circulation and the absorption of the hæmatoma around the injured vessels.
5. Ligature of the artery and vein above and below the anastomosis and excision is the operation of choice.

We have to thank Mr. W. H. Ogilvie for permitting us to record this case; and Miss Anna Zinkeisen for the drawing of the specimen, which is now preserved in the Museum of the Royal College of Surgeons.

REFERENCES

[1] HUNTER, WILLIAM, *Observations on Aneurism*, The Sydenham Society, 1844, 524 pp.
[2] SWAN, JOCELYN, *Brit. Jour. Surg.*, 1916, July, 169.
[3] MAKINS, GEORGE, *Surgery of the War*, 1919, **2**, 193.
[4] REID, M. R., *Bull. Johns Hopkins Hosp.*, 1920, **31**, 43.
[5] HOLMAN, EMILE, *Arch. of Surg.*, 1923, **7**, 64.
[6] MATAS, *Ann. of Surg.*, 1920, **71**, 403.
[7] PEMBERTON, J. DE J., and WAUGH, *Surg. Clin. N. Amer.*, 1939, **19**, 981.

EXPERIENCES IN REPARATIVE SURGERY OF THE UPPER LIMB

By PERCIVAL P. COLE
SENIOR SURGEON, SEAMEN'S HOSPITAL, GREENWICH

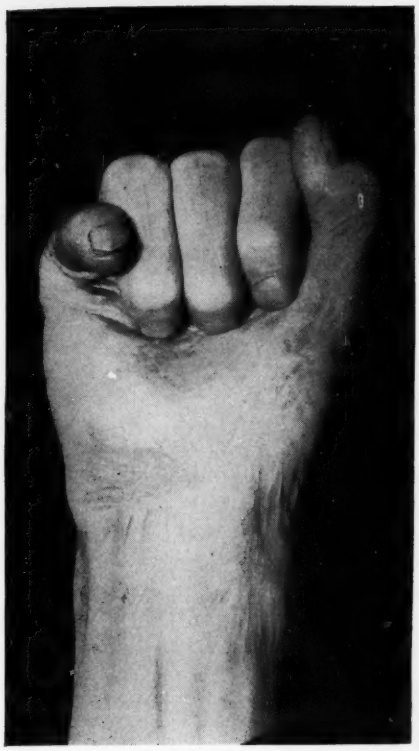
CICATRICIAL contraction affecting the tissues of the palm and fingers must be of frequent occurrence in industrial and service accidents. Many cases have been referred to me, and it is on the experience thus gained that the following descriptions are based. In nearly all the cases the cause has been a burn sustained in a laundry accident or produced by an electric current. An electrical engineer, extensively burned on the lower limbs, the face, and both hands, exhibited the most severe deformity and dysfunction. The burns on the lower limbs healed slowly and caused no disability. The face healed well under tannic acid coagulum, but the appearance

FIGS. 374, 375.—Photographs showing the improvement obtained by low-voltage X-radiation in keloid.

was marred by keloid scarring of the eyes, the nose, and the ears. The treatment of keloid is somewhat outside the scope of this discussion, but the photographs (*Figs.* 374, 375) are reproduced to show the improvement which can be obtained by surface irradiation with radium or by low-voltage X-ray therapy. The accident occurred in May, 1935, and the fingers had been kept supple and movements maintained by gentle manipulation during the process of healing. All attempts to control contraction in the palm were unsuccessful as is usual in such lesions.

Preliminary to surgical intervention the keloid, which was the most massive I have ever seen, was treated by low-voltage X-ray therapy (60 kv.), at a time when this was an entirely new procedure in this country. The treatment was supervised

FIGS. 376–379.—*Case* L. A. B. Showing the condition of the right hand before operation.



FIGS. 380–382.—Same case, showing the almost perfect functional and good cosmetic result obtained by whole-thickness skin-grafting operations.

by Professor Woodburn Morrison in the Radiological Department of the Royal Cancer Hospital and the reaction was calibrated by trial on patches of keloid above the right knee. The keloid on the back of the hands was considerably diminished, but the contractures were unaffected in bulk or disposition.

A grafting operation using a Thiersch graft was undertaken on February 7, 1936, on the back of the left hand to test the condition of tissues from the point of view of latent sepsis. Partial failure showed that latent sepsis was still present. It was decided to wait for some weeks and in the meantime to give a course of staphylococcal toxoid.

FIG. 383.—Same case, left hand. Showing the hand lying in the splint mould at the conclusion of a skin-grafting operation.

The condition of the right hand before treatment is shown in *Figs.* 376–379. The almost perfect functional and reasonably good cosmetic result obtained after a series of grafting operations using whole-thickness skin is illustrated in *Figs.* 380–382.

The left hand, seriously but less diffusely affected, has been chosen to indicate the technique employed, details of which are referred to later. *Fig.* 383 shows the hand lying in the splint mould at the end of the skin-graft operation. *Figs.* 384 and 385 indicate the size of the graft, while *Figs.* 386 and 387 show the result obtained.

The result of reparative work (using whole-thickness skin) on other severely contracted and crippled hands is shown in *Figs.* 388–396. It will be obvious that the same technique is applicable to Dupuytren's contracture. In fact, it is in my experience the only reliable means at our disposal for dealing with severe degrees of this disabling lesion.

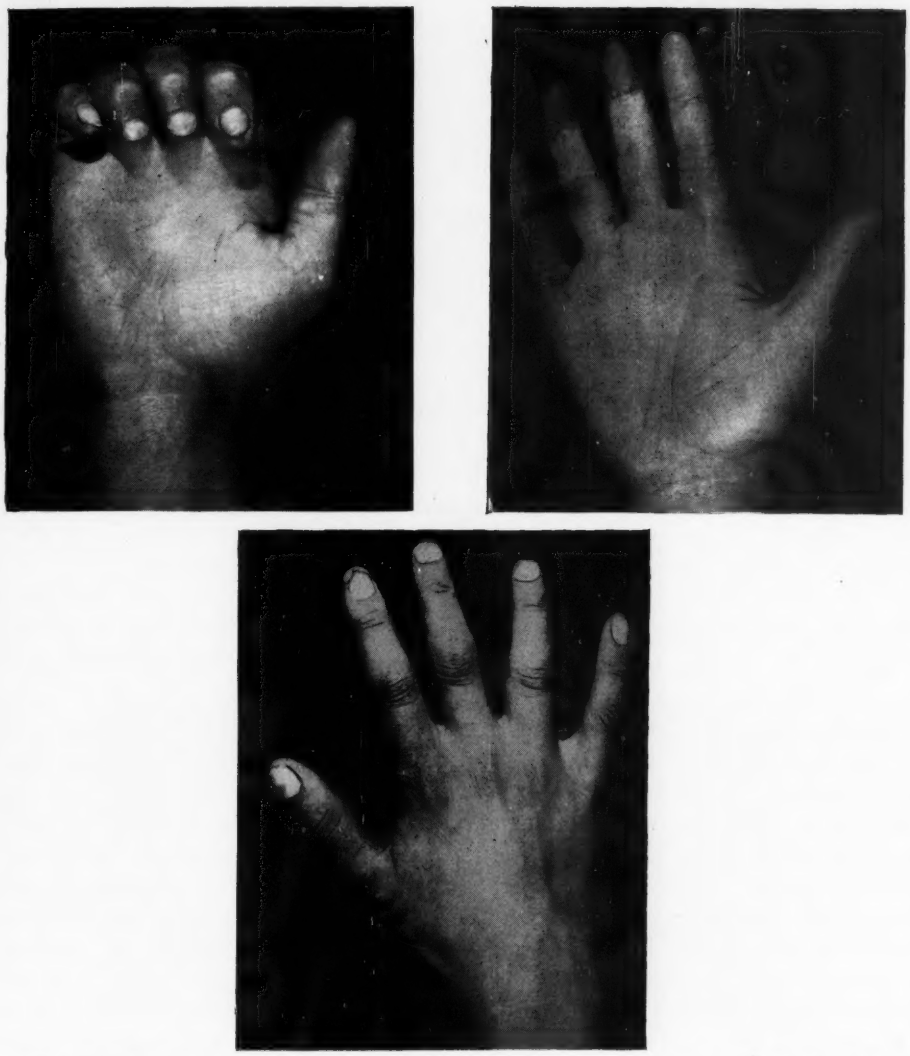
FIGS. 384, 385.—Same case. Showing the size of the graft.

FIGS. 386, 387.—Same case. Showing the result obtained.

FIGS. 388–390.—*Case* B. F. Photographs showing the results obtained after using whole-thickness skin-grafts in a badly crippled case.

FIGS. 391–393.—*Case* A. M Showing how full was the restoration of function in this badly contracted left hand.

In many cases with excessive scar-tissue formation and long-standing distortion it is impossible to straighten the fingers without rupturing the flexor tendons. Excision of the first interphalangeal joint from the dorsal aspect has been frequently performed at the same time as the skin-grafting without untoward effect. Experience



FIGS. 394–396.—*Case* C. B. Another example of the good results obtained by whole-thickness skin-grafting operations.

has taught that if removal of bone is insufficiently free, beyond that which will allow full extension, movements at the joint will be abolished or severely limited, particularly in young persons. I am inevitably reminded in this connexion of the advice given by Jacobson when discussing excision of the elbow-joint.

DISCUSSION OF METHODS EMPLOYED

Wolfe Grafting (Primary).—The surface of any raw area is irregular, its contours being determined not only by the distribution of cicatricial tissue but also

by the character of the different elements exposed, e.g., areolar tissue, muscle, or tendon. Variations in the solidity of the latter and in the resistance offered by the structures on which they lie make the problem of accurate impression-taking a more difficult one than would be at first supposed.

The medium which is to supply pressure (or over which pressure is to be maintained) must reproduce every irregularity of the surface. Application of the medium to a surface composed of tissues offering different resistances must produce distortion and pressure inequalities proportional to the force employed in its application.

It follows, therefore, that any material to be suitable must be capable of application with a minimum of force. The only mechanism that satisfies these essentials is a cast.

The preceding considerations indicate that the ideal medium would be a liquid which without expansion or shrinkage would become solid by change of state or temperature. Further, the material must be adaptable to conditions of asepsis and should be easily worked. To obtain the maximum benefit from such a liquid it would have to be poured directly on to the raw area and its use would therefore be restricted to flat surfaces in accessible positions. A suitable medium is difficult to find. The metal alloys with low melting-point do not become liquid at a heat that is tolerable. I have used plaster-of-Plaris retentive apparatus during the healing of denuded areas likely to cause disability by unchecked cicatricial contraction, but so obvious are its disadvantages that I have not been induced to use it for more direct contact. I have put Negocoll to some tests, but its tendency to dry and distort is a serious disqualification, which I have failed to overcome.

Failing a liquid, the next best thing is a sterile solid material that becomes very soft at a temperature well below that of boiling water and hardens and remains hard at body heat without shrinkage. Stent's composition, or compositions of a like nature, fulfils these conditions. With the added safeguard of preliminary scalding, bacteriological tests have confirmed sterility. Rapid cooling and hardening can be secured by irrigating with iced 1–1000 biniodide in which the mould can be kept until required. At body heat the impression of the raw surface is maintained, but mass rigidity is diminished unless used in bulk, which is unwieldy. It follows, therefore, that ' backing ' is advisable, and nearly always necessary. This backing takes the form of a metal tray shaped to the part in such a way that a minimum of composition is used and a sufficiently large bearing area obtained. The tray is conveniently fashioned from perforated zinc sheeting, and can be made before the operation, when, as for the hand, the long narrow troughs for the fingers require to be strengthened by an edging of metal tape. In other cases the tray is made at the time of operation, after the extent and disposition of the raw surface is known. The provision of a large bearing surface is absolutely essential to avoid locally concentrated pressure, with consequent pain and ulceration. The splint-mould can be trimmed to give temporary relief, but the pressure balance has been upset and, at the best, a local failure will result.

In taking the impression, the tray, with its contained composition, should be approached to the part. When this is not possible, the part must be applied to the tray, but much greater care is required to obtain an accurate impression. It is important that the part or parts shall lie easily in the selected position. Correction or over-correction of deformity by force must be avoided while the impression is being taken, for it is evident that in maintaining this position the

same amount of force as that originally applied must constantly be exerted by the cast, with resultant pain and pressure ulceration.

The impression when taken should show the outlines of the raw area sharply defined. Pattern lead is used to indicate the shape and extent of this raw area. This material is easily sterilized, easily adapted to any kind of surface, and easily cut. It has sufficient rigidity to permit of easy handling, and when flattened out and laid on the surface of skin selected will provide an accurate measure of the amount to be removed. The skin is removed by dissection so that no fat is taken up on its deep surface.

The outline of the pattern is followed on the skin and no allowance is made for shrinkage because the tension of the skin when transferred to the recipient site must be exactly that which originally obtained. Perfect hæmostasis having been secured at the site to be grafted, the separated skin is transferred thereto. This is conveniently effected by passing fine catgut stitches through opposite ends of the graft and using these as a means of transport and to suture it in its proper place at these two points. The graft is then accurately sutured in place by very fine interrupted catgut sutures which will be absorbed in the course of a few days. All that remains before the mould is finally returned to lie snugly against the parts whose impress it bears is to arrange that a single layer of gauze moistened in sterile liquid paraffin intervenes between it and the transplanted skin. This is the only dressing used and is usually applied by draping the relevant area of the mould. Direct contact between composition and graft was formerly adopted, and in certain forms of Thiersch grafting all dressing is still omitted. When firmly strapped and bandaged, uniform light steady pressure will thus be exerted. With perfect asepsis, inflammatory swelling will be slight and transient. Even so, the increased and localized pressure thus produced will be beneficial at a time when the fate of the graft depends upon accurate contact with the recipient bed.

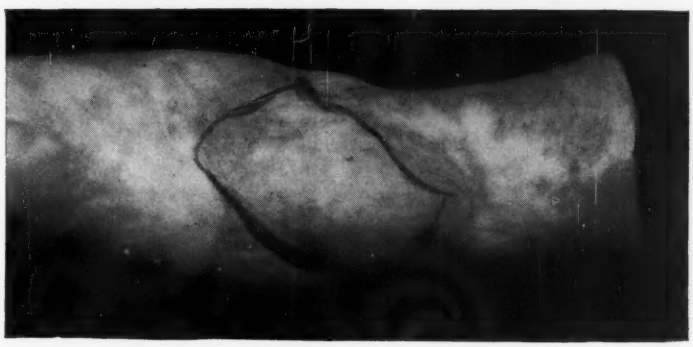


FIG. 397.—*Case* M. P. Photograph showing how successful even a large skin-graft may be. The patient had previously had limited extension at the elbow owing to surface contraction.

Strapping and bandage should be applied very firmly, for I have never known anxiety to arise from signs of constriction.

No matter how long the operation or how much manipulation has been necessary, pain is seldom severe and should cease entirely after 48 hours. The first dressing should be undertaken not later than the second day. The graft and surrounding skin are cleansed gently with S.T. 37 (a solution of hexyl resorcinol with glycerin), the surrounding skin is moistened with alcohol, dried, and powdered, and the splint with single layer of gauze in paraffin returned to place.

The patient can get up as soon as the inclination arises unless the site of grafting makes this inconvenient.

Dressing should be done daily or every other day for at least a fortnight and the splint maintained in position for approximately three weeks. Non-spirituous flavine paraffin is substituted for paraffin at the end of the first week, and an aqueous solution of flavine containing 10 per cent spirit at the end of a fortnight. The behaviour of these grafts is variable: when completely successful the first dressing is practically dry, no exudation subsequently occurs, and there is no shedding of even the surface epithelium. The dead white of the grafted skin gradually gives place to pink and soon conforms indistinguishably to the coloration and texture of the skin around. A phenomenon which sometimes occurs is vesication. This is very superficial, is clear evidence of a reaction depending on vitality, and does not in any practical way affect the outcome.

FIGS. 398–400.—*Case* E. D. Photographs showing the result obtained in this case of contracted and tangled fingers. The graft was cut in three pieces and joined on the hand.

The size of graft that can be employed with complete success may be judged from the photograph (*Fig.* 397) of a girl with surface contraction limiting extension at the elbow and causing tension productive of considerable discomfort.

The photographs in *Figs.* 398–400 show the contracted and tangled fingers resulting from damage to a laundry worker, and the condition of the hand a few days after operation and at a later date. The extent of the whole-thickness skin-graft is shown. It was cut in three pieces, which were joined on the hand.

In grafting with whole-thickness skin, partial and even occasionally total failures will occur, but perfect results may be expected when hæmostasis, asepsis, and perfect conditions of pressure are procured. The condition which is most evasive and most difficult to assure is pressure. Endeavour should be concentrated on improvement in this direction.

Finger-tipping.—As a general rule reparative work on the hands distal to the wrist is better accomplished by free skin-grafting than by pedicled flap. Attempts made in the latter way that have come under review have confirmed its unsuitability. The result often enough is a clumsy botch which has failed in its purpose. There is, however, one type of damage for the repair of which the pedicle flap is particularly successful. This is a type of accident where the pulp of the finger with a varying part of the nail is sheared off obliquely. The loss of tissue increases distally, the phalanx may be partly exposed, but the attachment of the profundus tendon to its base is not involved.

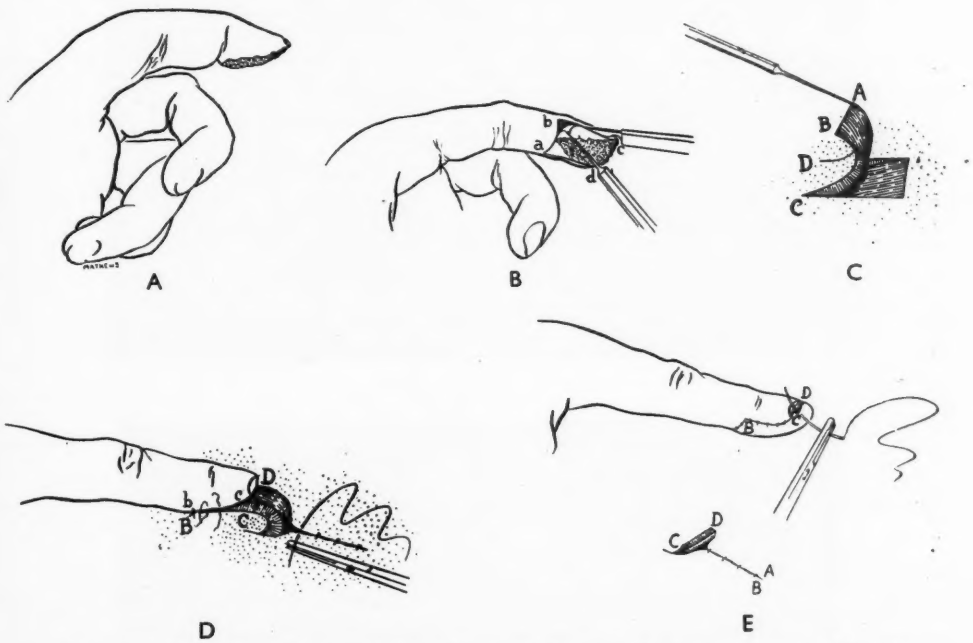


FIG. 401.—Showing stages in the technique of finger-tipping. A, The damaged finger; B, Squaring-up the wound; C, Flap made on abdominal wall; D, Finger sutured to flap so that *b*, *c*, and *d* contact *B*, *C*, and *D* respectively, and abdominal incision closed; E, Flap severed from abdomen and finger sutured.

The diagrams in *Fig.* 401 show the method in use for the purpose mentioned. The turned-back, or truly-named reflected flap, embodies a principle which can be adapted with advantage to many sites. As used here the finger lies naturally, the

FIGS. 402, 403.—*Case* C. McA. Photographs showing the satisfactory results obtained by finger-tipping.

FIGS. 404, 405.—*Case* N. L. Showing the result of direct transfer of tissue from abdominal wall to correct gross distortion by cicatricial contraction at wrist-joint.

area from which the flap has been reflected is open for suturing or dressing, and the mobility permitted to the hand and finger is quite considerable.

Repair in this way can be undertaken immediately with the result shown in the photographs (ring and middle fingers) (*Figs.* 402, 403).

As a secondary procedure, it can be applied to save the proximal half of the second phalanx, to which strong flexor action can be imparted by the flexor sublimis, in cases which would otherwise be amputated at a higher level. Considerable functional and cosmetic benefit derives from this conservation, which will be encouraged by the knowledge that fingers rendered useless by inadequate tissue covering can be restored to full use by this process of re-tipping. This simple procedure has proved its value in the reparative surgery of the hand.

The introduction by direct transfer of tissue from the abdominal wall to correct gross distortion by cicatricial contraction at the level of the wrist-joint is shown in the photographs in *Figs.* 404, 405.

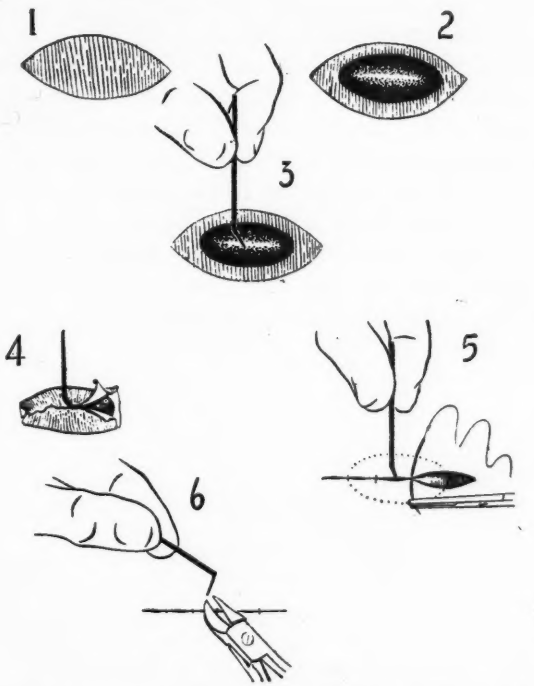


FIG. 406.—The steps in a manœuvre which facilitates Thiersch grafting by inlay. 1, The raw area; 2, Raw area with Stent composition; 3, Heated iron wire inserted into Stent; 4, Stent covered with skin-graft; 5, Skin sutured over; 6, Iron wire clipped off.

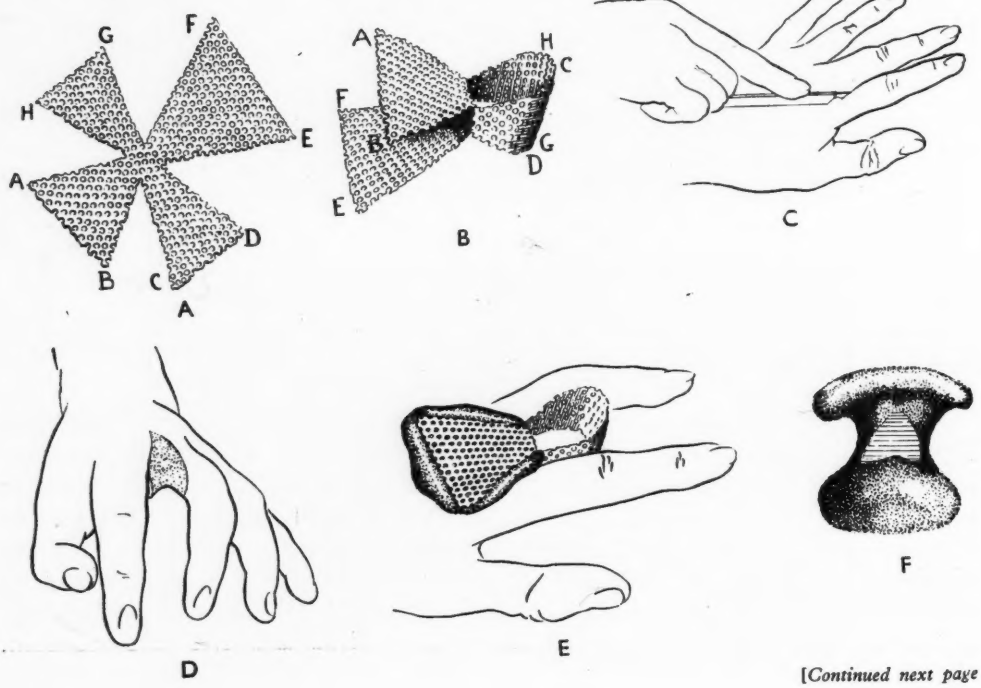
Thiersch Grafting.—The factor of pressure is of equal importance in primary Thiersch grafting. In a review of this form of grafting,* more frequently used because results are allegedly more certain, partial failure is recorded in 40 per cent of all cases. It is stated that inlay grafting gives a higher percentage of complete success. An occasional failure can and probably must be accepted on the score of fallibility, and with this allowance for error the inlay grafting of Esser can be regarded as the perfect method subject to its limitations. In this method steady,

* B. K. Rank, "Use of the Thiersch Skin-graft", *Brit. Med. Jour.*, 1940, I, 846.

even pressure is maintained by utilizing the mechanical properties of the tissues, and the pressure-dressing factor, subject to such variation and difficulty of control, is eliminated. A manœuvre which makes easier the necessary manipulations in this form of grafting is illustrated (*Fig.* 406).

The figures illustrate the use of a length of soft-iron wire heated at the pointed end and so easily pushed into the Stent composition which has been shaped as required. Implanted in this way the wire forms a convenient handle giving the operator greater control in adjusting the skin-graft as covering for the mould and steadying it the while it is buried by uniting the margins of the raw area over it. Prior to the insertion of the last stitch, centrally placed, the wire is cut off flush with the surface of the mould, the point being left imbedded in it. A further and successful innovation is the touching of the Stent mould with mastisol applied by a fine camel-hair brush. By this means the graft is made to adhere and its smooth adjustment is made easy, with tendency to curl abolished. Adhesion of the graft to the pressure producing surface is a principle that can be extended to open areas, as will be seen in the description that follows.

Primary Grafting of Finger Clefts (*Fig.* 407).—The use of direct pressure is well illustrated by the method employed to skin-graft the raw area left after excision of scar tissue that has led to the partial or complete obliteration of the digital clefts. This procedure has wide application, particularly in burns of the hands, for not only will normal spread of the fingers be restored but tension on the skin at the prominent proximal phalangeal joints will be indirectly relieved, thereby overcoming the tendency to crack when subjected to normal stress. The illustrations explain themselves. The splint can be cut and fitted in a few minutes. It can be strengthened by binding the edges with metal tape, but this is not really necessary.



[*Continued next page*

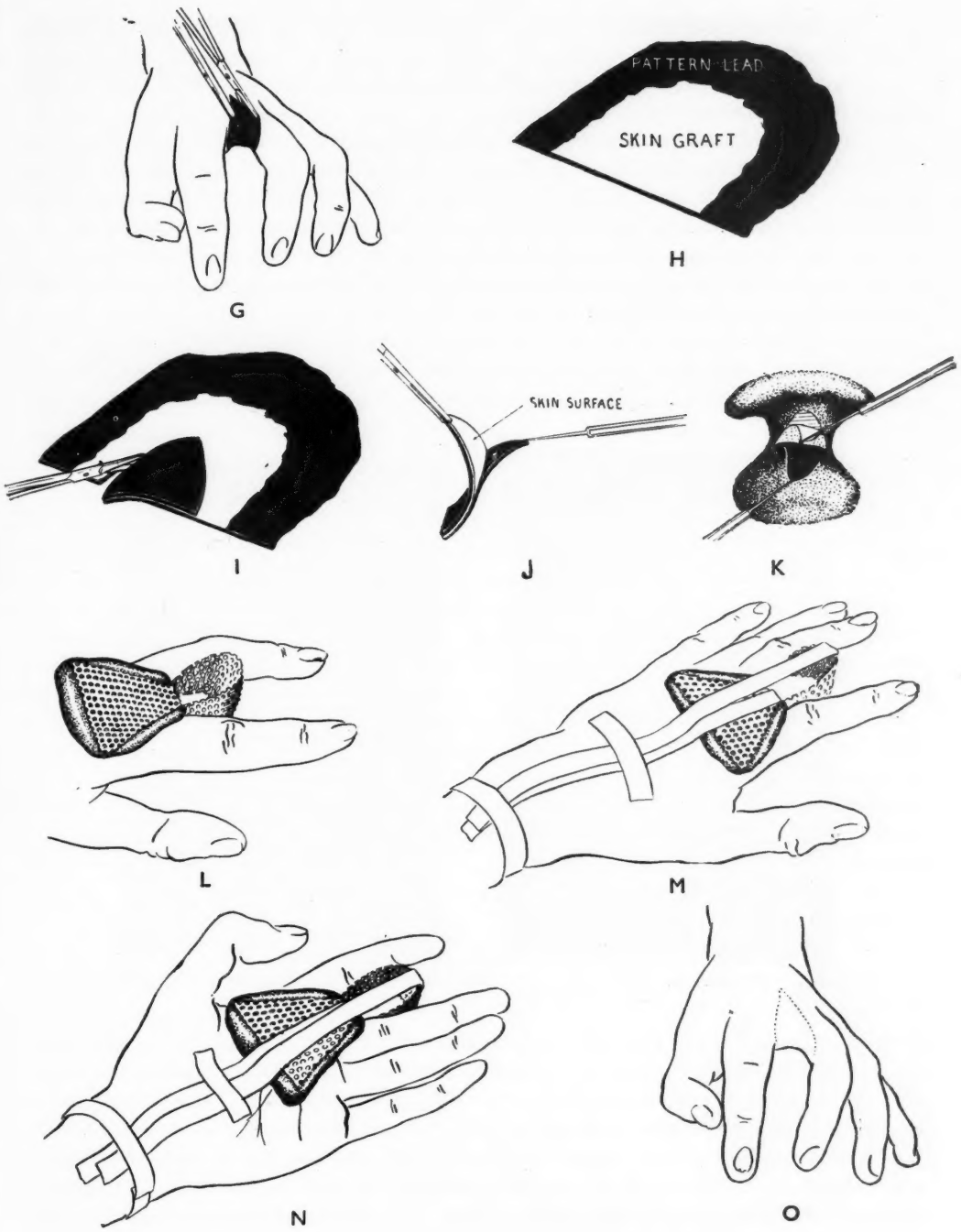


FIG. 407.—A, Thin perforated zinc cut to shape. B, Splint made by bending; junction of CD with HG strengthened by solder or strapping. C, Incision to separate fingers. D, The raw area. E, Making the Stent mould. F, Impression of raw area on Stent. G, Pattern lead is trimmed slightly larger than raw area. H, Skin-graft placed, with raw surface down, on sheet of lead. I, Pattern lead placed on top and skin-graft cut (sandwiched between lead sheets). J, One sheet of lead being peeled off. K, The skin surface is placed on Stent mould and second piece of lead removed, exposing raw surface of skin-graft. L, Splint (with skin-graft in position) is thrust back between the fingers. M, N, Bandages for holding splint. O, Skin-graft in position.

The sandwich method whereby a graft can be cut to any shape or size required is also illustrated.

The graft is made to adhere to the area of imprint by the use of mastisol in the manner previously described.

No dressing is used and the assembled apparatus is left untouched for ten days.

On the tenth and twelfth days the splint is removed and then replaced, being covered with a single layer of gauze moistened with non-spirituous flavine paraffin after a toilet such as has been described in dealing with the whole-thickness graft.

On the fourteenth day the splint is removed and the grafted cleft covered for a few days with gauze moistened with flavine 1–1000 with 10 per cent spirit. Failure has yet to be recorded.

Shrinkage inevitably occurs in all forms of Thiersch grafting and is manifested in more ways than one. *Figs.* 408, 409 illustrate a case in which extensive grafting

FIGS. 408, 409.—*Case* E. L. Showing the result obtained by Thiersch grafting for burns sustained by falling in the fire during an epileptic seizure.

of face and scalp was required for the results of burns sustained, in an epileptic, by falling into the fire. It is included, not so much to indicate the results of work on the face, as to stress the difficulty of free grafting on such a convex surface as was presented by the very large granulating area on the scalp. This was grafted at one sitting by the open method with complete success, but a ring of denuded tissue appeared at the greatest convexity caused by the splitting of the grafts at this site as the result of contraction. When whole-thickness skin is used ensuing contraction is much less, and this, together with its greater durability, makes it the method of choice in certain sites.

Results are influenced by the character of the tissues covered, not because of any inherent properties but because imperfections in method are magnified or minimized thereby. It is stated, for instance, that a Thiersch graft fails when applied to tendon denuded of its sheath. I have never been tempted to put this

procedure to the test, but bare tendon has been covered with *whole*-thickness skin with consistent success. Failure less often attends the use of the Thiersch graft for the simple reason that equal success with whole-thickness skin demands a more perfect technique. The thin graft is employed, not because it is more suitable, but because a higher attainment has been contentedly sacrificed to more facile success. The problem of primary skin-grafting is essentially the problem of pressure.

Secondary Skin-grafting (Thiersch).—Far otherwise is it with secondary grafting. In the review referred to previously, pressure was employed in exactly the same way for secondary as for primary grafting, and partial failures increased to 85 per cent: in 38 per cent the degree of failure, although not defined, was certainly not negligible. I submit that the problem of pressure does not arise in the case of secondary skin-grafting. The endeavour to convert a secondary into a primary procedure by scraping away infected granulations is doomed to failure. Improvement in results is small and may well be due to other beneficial factors.

Advice to remove granulations was current in authoritative text-books before the last war, and its revival can only be explained by an endeavour to instal and extol pressure as the operative and universal factor in all skin-grafting technique. Sepsis surely cannot be overcome by scraping in an operative field already infected, nor can pressure be expected to exert bactericidal influence.

The solution of the problem of secondary skin-grafting is the elimination of sepsis. The ideal of sterility can be attained. Diphtheroids can be disregarded, but pus-forming organisms such as staphylococci and streptococci are a menace in proportion to their number and distribution. Moreover, the granulations can be rendered hard and dry so that discharge is practically absent. In most cases—70 per cent at least—macroscopic appearances can be relied upon to indicate when the surface is ready for grafting. It is best, however, to check naked-eye appearances by bacteriological findings. Streptococcus, particularly the hæmolytic variety, is an organism difficult to abolish, but merthiolate is frequently successful where other applications have failed. Sulphonamide drugs taken internally have no effect and I have had no success with preparations of the drug applied locally.

A sequence of applications which has rarely failed to produce a suitable soil is as follows: The basic application is eusol. The skin at the margin of the area is thoroughly cleansed with S.T. 37 every time the eusol dressing is changed. When the bed of granulation tissue has become smooth, red, and nearly free from purulent discharge, the bacterial content is tested by smear and culture. The growth of an occasional colony of cocci or other pus-producing organisms can be neglected, as can diphtheroids. The eusol is replaced by a flavine preparation, aqueous or with paraffin and containing 10 per cent of spirit. This is used twice daily for two or three days and a further smear and culture are taken. All being well, the area is dressed every two hours for 24–48 hours with 10 per cent saline. The dressing now should be merely discoloured by almost negligible serous exudate and stained, here and there, with blood. On the table the skin around is cleansed with S.T. 37, but the area is untouched and the skin-graft or grafts are arranged upon it.

I submit that the cases that do well with pressure would do equally well and probably better without pressure. Where conditions are known to be such that success may confidently be anticipated, the employment where feasible of a graft large enough to cover the whole area is justified; but the same procedure adopted

in doubtful circumstances is a totalitarian commitment too fraught with hazard to commend itself. It may be true that fixation of multiple grafts is practically impossible: *per contra* it is unnecessary. Failure to skin-graft a granulating surface should be extremely rare. So much is this so, that in positions where steady and even pressure cannot be conveniently maintained, primary grafting may be rejected in favour of secondary grafting, undertaken some ten days later when the wound has begun to granulate.

In cutting Thiersch grafts, the skin and the grafting knife or razor are freely lubricated by wiping with liquid paraffin. I began to use paraffin in this way more than twenty years ago and have continued to use it because it facilitates the cutting of the graft. The graft can be conveyed directly to the granulating surface, or, better, to avoid possible infection of the donor area, to a pad moistened with warm saline or to a sheet of pattern lead from which it can easily be slid off.

Distribution is of some importance. On a flat surface, grafts should be so placed that each graft related to the margin will stretch over a relatively large part of the central area (*Fig.* 410).

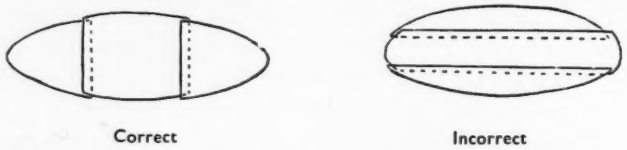


FIG. 410.—Diagram showing the correct and incorrect way of laying grafts on a flat surface.

When an unyielding and very convex surface presents, grafts should be disposed in strips across the convexity and not arranged to follow it (*Fig.* 411).

FIG. 411.—The correct and incorrect method of laying grafts on a convex and unyielding surface.

When the graft or grafts are arranged so that they just overlap each other and the margins of the area involved, they are firmly pressed into place by a gauze swab made to assume a ball-like contour and saturated with sterile paraffin. It is surprising how quickly the grafts adhere so that a free, forceful rolling motion can be employed without fear of movement or detachment. A wire cage supporting a loose cover of gauze is fastened in position to enclose and protect the area. If, as sometimes may happen, secretion collects under and partially raises a graft from its bed, this is expressed, with or without puncture, by pressure with a gauze pad moistened with paraffin. The surface of the grafts is moistened from time to time with liquid paraffin to prevent drying. Dried secretion will collect at the junction of the grafts and at the circumference of the grafted area. At the end of a week or so this is removed by the application to it of cotton-wool soaked in a mixture of equal parts of a saturated solution of sodium bicarbonate and normal saline. A dressing of non-spirituous flavine-paraffin (1–1000) or tulle gras may now be applied for a few

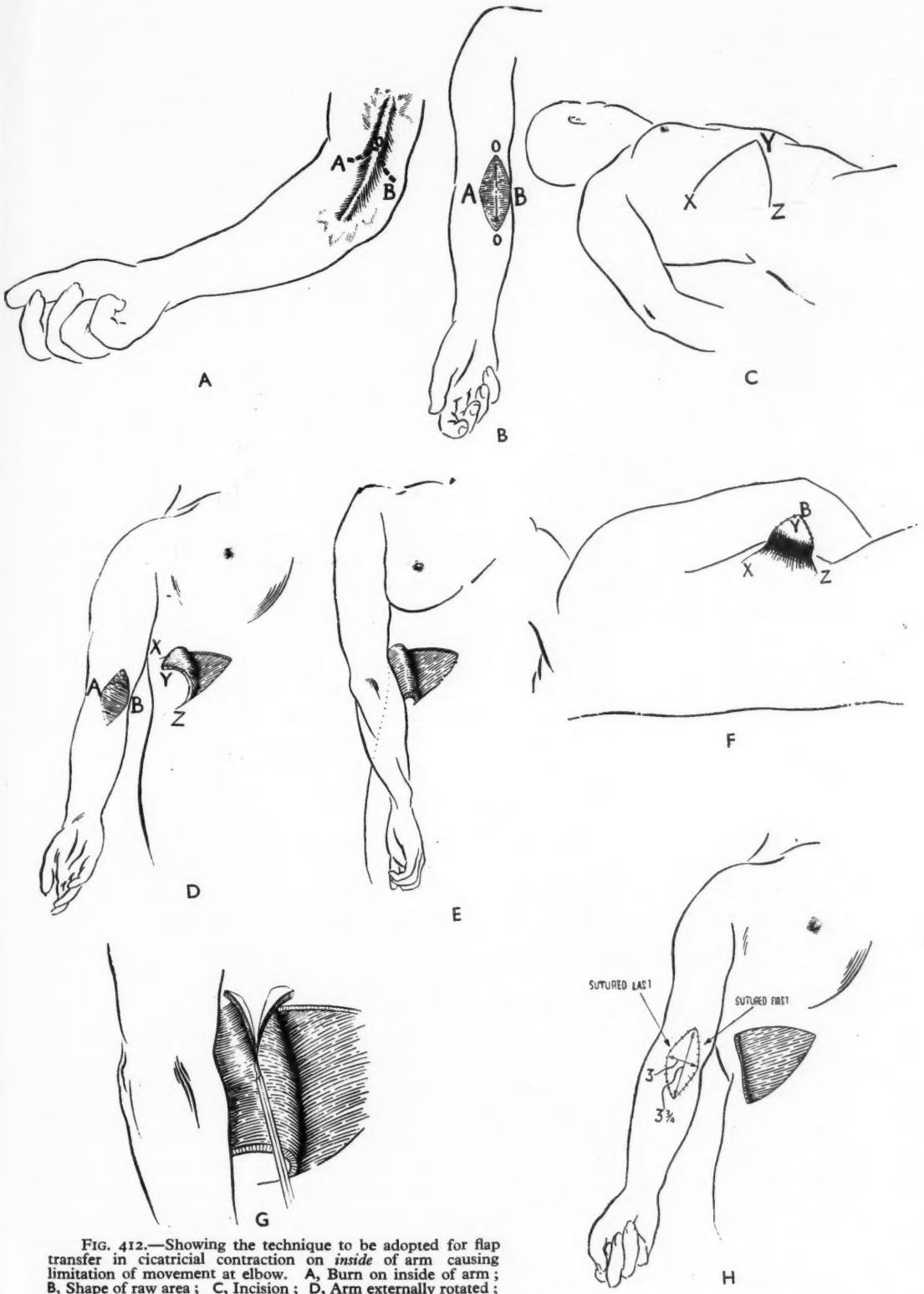


FIG. 412.—Showing the technique to be adopted for flap transfer in cicatricial contraction on *inside* of arm causing limitation of movement at elbow. A, Burn on inside of arm; B, Shape of raw area; C, Incision; D, Arm externally rotated; E, Arm internally rotated; F, Flap viewed from behind; G, Flap being severed; H, Raw area remaining of chest wall.

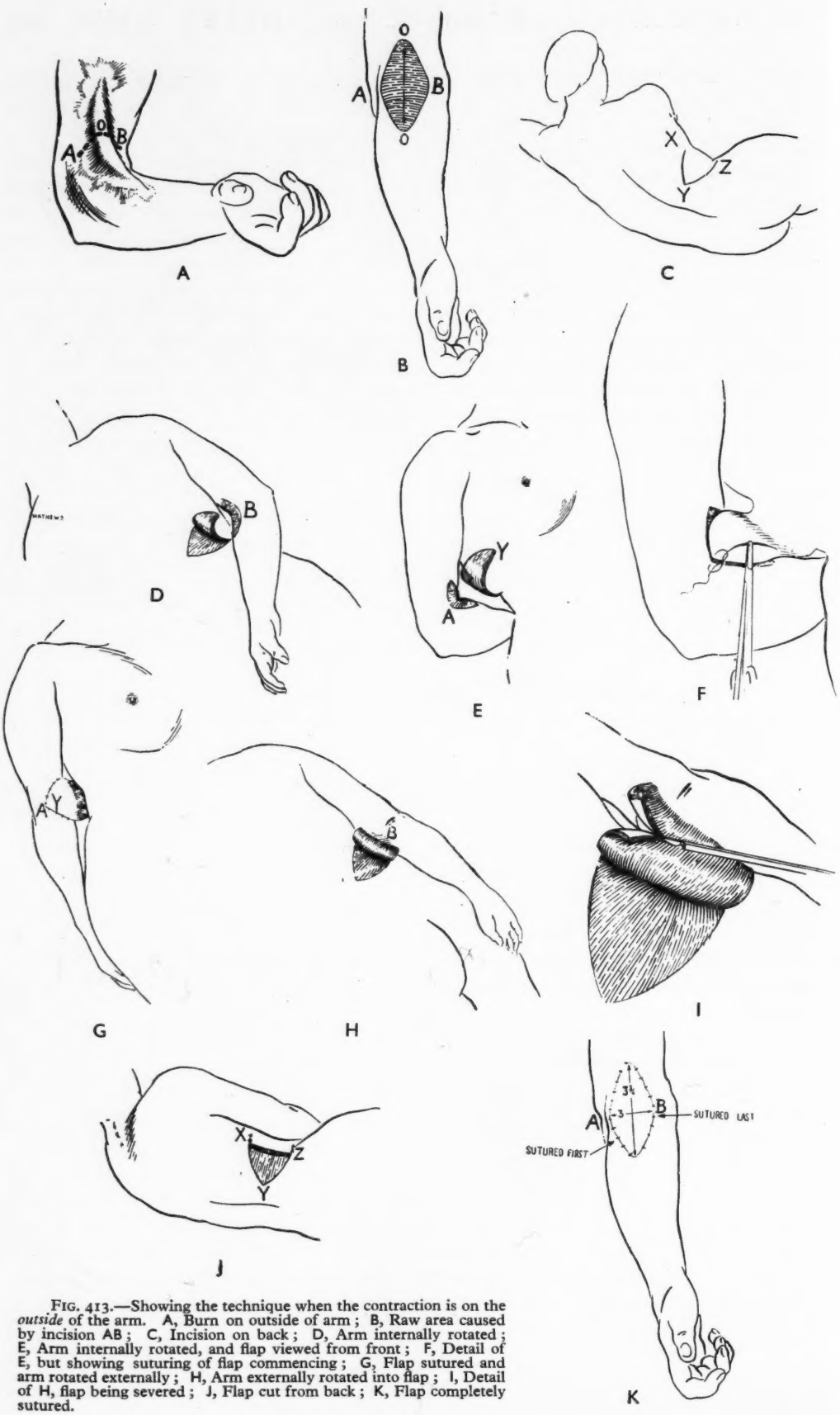


FIG. 413.—Showing the technique when the contraction is on the *outside* of the arm. A, Burn on outside of arm; B, Raw area caused by incision AB; C, Incision on back; D, Arm internally rotated; E, Arm internally rotated, and flap viewed from front; F, Detail of E, but showing suturing of flap commencing; G, Flap sutured and arm rotated externally; H, Arm externally rotated into flap; I, Detail of H, flap being severed; J, Flap cut from back; K, Flap completely sutured.

days, and at the end of a fortnight or so a dusting powder can be used with protection of any suitable kind against trauma to the still susceptible area. After skin-grafting operations on the hands, application of lanolin will help to restore pliability. Sleeping gloves may conveniently be worn.

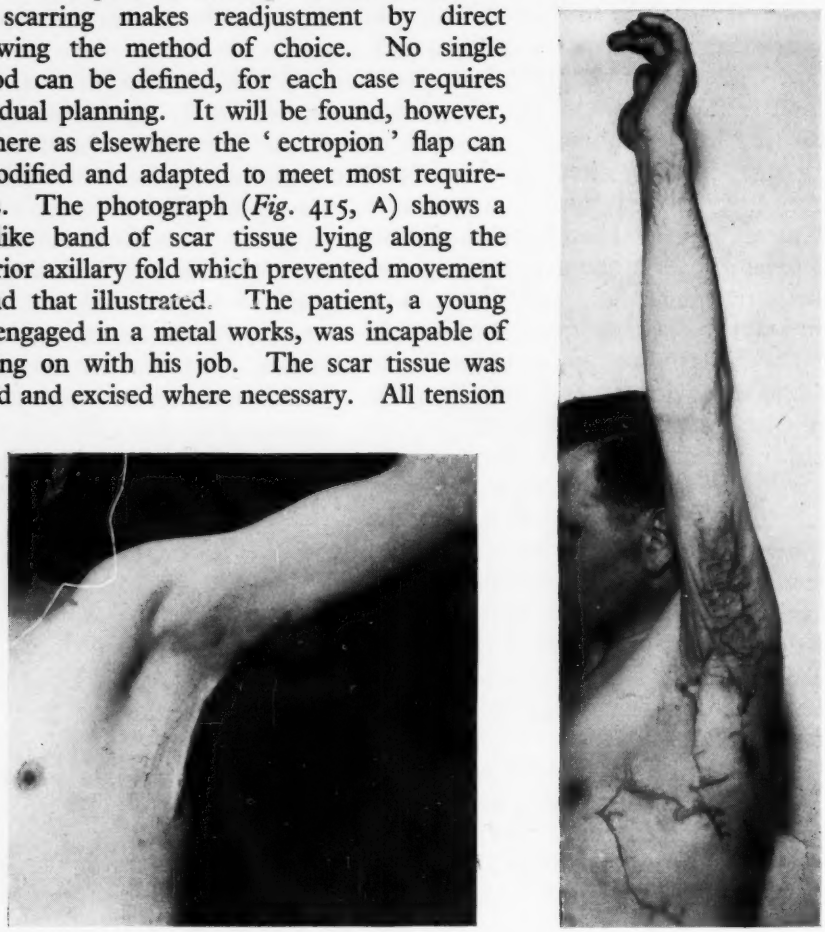
Limitation of Movement at Elbow (*Figs.* 412, 413).—Cicatricial contraction causing grave disability may affect tissues not only over a wide area but to a considerable depth. Repair and restoration of function can only be fully effected by the introduction of tissue like to that which has been damaged or destroyed. A purely surface measure such as skin-grafting will not suffice. Tissue in mass must be requisitioned and will take the form of a flap borrowed from the neighbouring tissues or from a distant source by direct and immediate or indirect and delayed transfer. Wherever possible direct transfer should be employed. Time is saved, at least one and possibly two operations are eliminated, and the results are more certain. Contractures particularly associated with burns are apt to occur in the neighbourhood of joints, and the crippling influence affects more seriously the upper limb in which free mobility rather than weight-bearing stability is the outstanding feature of function. The elbow and wrist are the regions where direct transfer from a distance is the method of choice. Scar tissue inhibiting extension at the elbow may develop towards the inner or outer side of its anterior aspect. The drawings (*Figs.* 412, 413) illustrate the method to be employed in both these situations.

FIG. 414.—*Case* E. B. Photograph showing complete restoration of extension at the elbow brought about by the use of a flap (*Fig.* 413) measuring $3\frac{3}{4} \times 3$ in.

In both cases the turned-back or reflected flap is employed and the movement of the limb is made use of to rotate the limb into the flap. When the scarring affects chiefly the inner aspect the flap is reflected from the front, and the limb, held in a position of extreme external rotation at the shoulder-joint at the beginning of the operation, is rotated in (*Fig.* 412). When the outer aspect is chiefly concerned, the flap is reflected from the back, and the limb, starting in a position of extreme inward rotation, is rotated out (*Fig.* 413). The operative area cannot be completely closed, but any small raw surface left has had no deleterious effect on the result. The amount of play allowed is surprising, and is of value in mitigating the stringency of fixation and providing easy access for inspection and dressing. The raw surface left on the trunk by the removal of the flap can be filled either by direct borrowing or by skin-grafting. The same method is applicable to the front of the wrist, but owing to lesser girth and freer movement, all replacement can be undertaken from the front.

The photograph (*Fig.* 414) shows restoration of full extension of the elbow brought about by the introduction by this method of new tissue measuring $3\frac{3}{4}$ by 3 in.

Limitation of Movement at the Shoulder.—Crippling limitation of the movements of the shoulder girdle may be caused by cicatricial contraction occurring in or around the axilla and usually resulting from burns. The contractures are frequently associated with the formation of keloid, which may be of considerable extent. The presence of ample tissue and inevitable scarring makes readjustment by direct borrowing the method of choice. No single method can be defined, for each case requires individual planning. It will be found, however, that here as elsewhere the 'ectropion' flap can be modified and adapted to meet most requirements. The photograph (*Fig.* 415, A) shows a rope-like band of scar tissue lying along the posterior axillary fold which prevented movement beyond that illustrated. The patient, a young man engaged in a metal works, was incapable of carrying on with his job. The scar tissue was incised and excised where necessary. All tension limiting movement was relieved by direct borrowing, and in three weeks free movement was restored (*Fig.* 415, B).



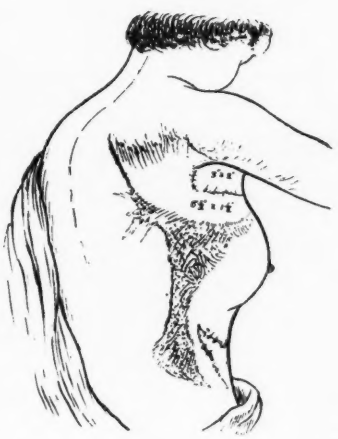
A B

FIG. 415.—*Case* A. R. A, Showing a rope-like band of scar tissue lying along the posterior axillary fold which limited movement to the degree shown. B, The result obtained by excising scar tissue and introducing skin-grafts.

Fig. 416 illustrates the case of a young girl who was so severely burned that the elbow could not be extended beyond a right angle and the arm was practically bound to the side by the formation of scar tissue in the axilla. She had been discharged from a large suburban hospital and was the more concerned because of her athletic ambitions. The new tissue at the elbow was transferred by the method illustrated

in *Fig.* 412. The axilla was reconstituted by direct borrowing. The area involved by the burn was very extensive, as will be seen by the diffuse scarring present.

A



B

C

FIG. 416.—*Case* J. W. Severe burns prevented extension of the elbow beyond a right angle, and the arm was practically bound to the side by scar tissue formed in the axilla. A, Photograph showing the graft inserted at the elbow. B, Illustrating the extent to which the axilla had to be reconstituted. C, Photograph showing the final movement possible.

The patient has come under observation again recently and the photograph indicates the range of movement now so fully restored that she plays tennis with an over-arm service and swims without even a reminder of restricted ability.

DUMB-BELL GANGLIONEUROMA OF CHEST

By DONALD PATERSON
PHYSICIAN TO THE HOSPITAL FOR SICK CHILDREN, GREAT ORMOND STREET, LONDON
AND ROBIN S. PILCHER
PROFESSOR OF SURGERY, UNIVERSITY COLLEGE HOSPITAL, LONDON

A FULL account of the various types of dumb-bell tumours is given in the paper by Eden in this JOURNAL (p. 549). The ganglioneuromata are rare, and not all of them are of the dumb-bell type. Their pathology has been discussed by Eden. A case somewhat similar to ours, in a child of $7\frac{1}{2}$, but without the dumb-bell feature, has been described by Sophian,[1] and a case of combined cervical and thoracic tumour with tracheal obstruction by Riggs and Good.[2]

CASE REPORT

HISTORY.—P. G., a boy, aged 4, was admitted to Great Ormond Street Hospital on August 2, 1940, with a history of asthma since he was a year old. He had had whooping-cough at 5 months and measles at 1 year.

On admission he was breathing stertorously and examination of the chest showed an area of dullness with absent breath-sounds over the upper half of the right side behind, while in front the right apex was resonant and the breath-sounds were but little diminished. X-ray examination of the chest showed a rounded opacity in the upper part of the chest on the

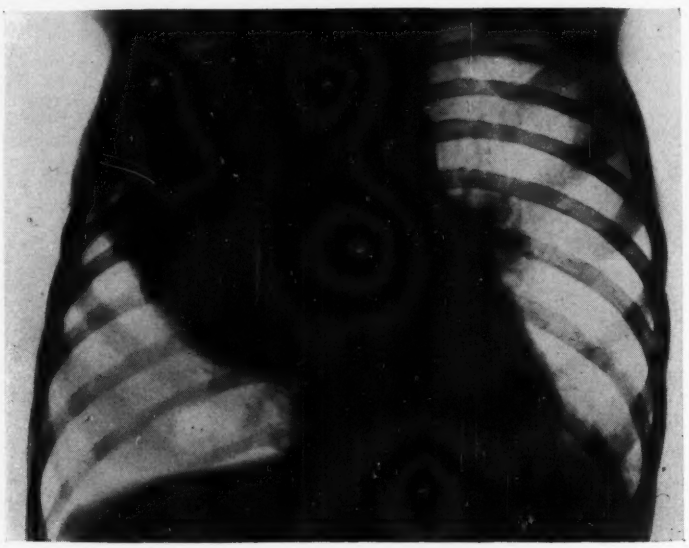


FIG. 417.—Antero-posterior radiograph of chest showing outline of tumour on right side.

right side, apparently arising from the posterior mediastinum (*Figs.* 417, 418). The tumour was aspirated from behind and fluid resembling pure blood was withdrawn on three occasions.

The child was transferred to Leavesden Emergency Hospital on August 23, 1940, where further radiographs were taken for evidence of skeletal changes. It was thought that the tumour might be of the dumb-bell variety, and pictures were taken to show the ribs and inter-vertebral foramina. There was widening of the posterior end of the fourth space, with

erosion of the fourth rib (*Fig.* 419), but no enlarged foramina were seen. Examination of the central nervous system for evidence of intraspinal tumour showed no abnormality, but spinal puncture was not done.

OPERATION.—The tumour was removed on September 5, 1940. Intratracheal gas-oxygen and ether was given after paraldehyde premedication. The right side of the chest was opened by an incision in the fourth space, the fourth rib being divided at its angle to increase the opening. Behind the partly collapsed upper lobe was a firm purple tumour tied to the lung and chest wall by numerous filmy adhesions. These were divided and the tumour was found to be firmly attached to the chest wall in the paravertebral gutter. The bulk of the tumour was reduced by aspiration of bloody fluid from the lower part, which was cystic. The apex was continuous with a band of tissue which was taken to be the sympathetic trunk, which was divided. Below this the tumour was found to penetrate the posterior end of the fourth intercostal space, and as the projection could not be coaxed out it was cut across, to be dealt with after removal of the main part of the tumour. This allowed the

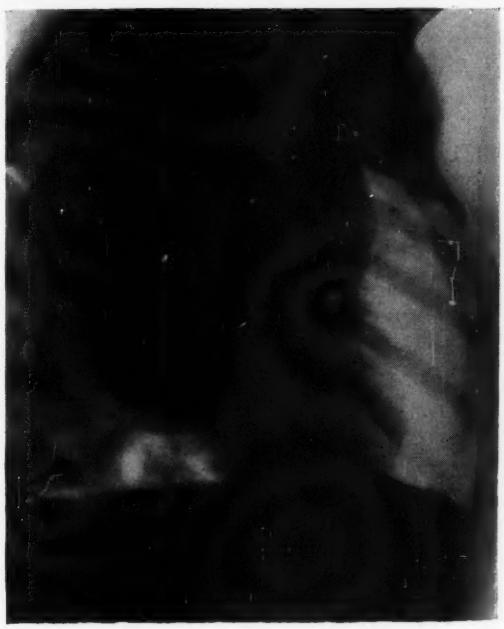


FIG. 418.—Lateral radiograph showing posterior position of tumour, with translucency in front.

tumour to be drawn forward, revealing another intercostal projection in the sixth space, which was easily removed by blunt dissection. The tumour was now only held by a few small strands of tissue at its lower pole and these were cut. The projection in the fourth space was next removed after enlarging the bony opening with nibblers. It had a small prolongation into the intervertebral foramen in which was incorporated the emerging nerve, which was cut. The tumour was removed mainly by blunt dissection with small gauze balls, and in spite of its vascular appearance no large vessels supplying it were found, but there was much oozing of blood from the numerous divided adhesions. During the removal of the tumour there was a sudden improvement in the child's respiration. The chest was closed without drainage. During operation a drip transfusion of 350 c.c. of blood was given. At the end of operation, which lasted 115 minutes, the pulse was of good volume. The child was placed in an oxygen tent with the foot of the cot raised.

During the night after operation a tension pneumothorax developed, which was relieved by a needle in the pleura, the leak ceasing after about eight hours, when the needle was removed. After this the child made a rapid recovery. He was nursed in the tent for a few days, and on the second day, as there was some fever, a course of sulphapyridine was started. Radiography of the chest on September 14 showed the lung re-expanded and a small

localized collection of fluid in the paravertebral gutter. There were signs of sympathetic denervation of the right arm, but no Horner's syndrome. He was sent home free from symptoms on September 22.

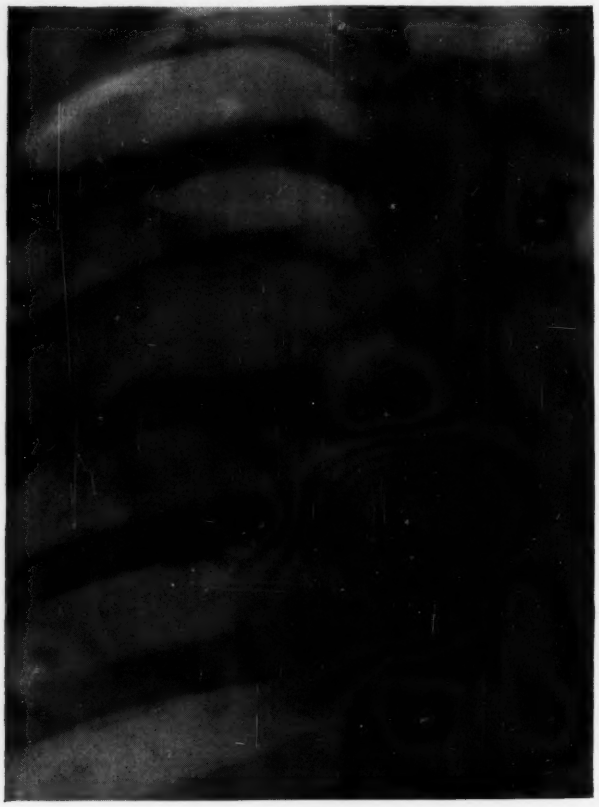


FIG. 419.—Radiograph of upper right ribs, showing widening of posterior end of fourth intercostal space and some erosion of the fourth rib.

FIG. 420.—Photograph of tumour, showing the two intercostal projections on its posterior aspect.

THE SPECIMEN.—The macroscopical appearance of the tumour is shown in *Fig.* 420, the microscopical in *Fig.* 421. In the former can be seen the two intercostal projections, the upper of which has been restored to its approximate position after removal. Professor S. Nevin, to whom we are indebted for the microphotographs, has examined the section and confirmed the diagnosis of ganglioneuroma.

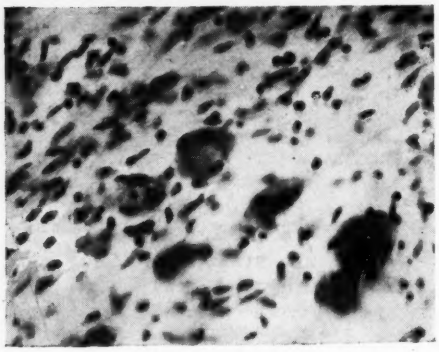


FIG. 421.—Microphotograph of tumour, showing ganglion cells. (× 270.)

REFERENCES

[1] SOPHIAN, L., *Ann. of Surg.*, 1935, **101**, 827.
[2] RIGGS, T. F., and GOOD, L. P., *Arch. of Surg.*, 1929, **19**, 309.

TRAUMATIC EXPULSION OF THE ASTRAGALUS

By H. J. McCURRICH, Hove
HONORARY ASSISTANT SURGEON, THE ROYAL SUSSEX COUNTY HOSPITAL

CASE REPORT

History.—R. A., aged 28, of Fleetwood, Lancashire, boatswain on a steam-trawler, was admitted to the Royal Sussex County Hospital on June 13, 1940, with an injury to his right foot as the result of his ship being mined.

Subsequently I obtained the following account of his injury: He told me that his ship had just finished sweeping for mines and he had removed his lifebelt and was aft, giving directions to his men. His language in describing what he was doing was too technical for me to follow, having no experience of mine-sweeping, but there appears to have been some object called a 'skid' which they were preparing to haul on board.

The next thing that he remembers is seeing a flash come through the deck. He does not remember *hearing* any noise and this I have found to be a curious feature constantly described by many patients wounded as the result of bombs or shells bursting close to them. The trawler had evidently struck an unsuspected mine.

Figs. 422, 423.—Antero-posterior and lateral radiographs.

The patient remembers being blown into the air and falling into the water. He came up amongst some pieces of wood, one of which he placed under each armpit. He was in the water for about 10 to 15 minutes before being rescued; he cannot swim. He was wearing ankle shoes. He could not remember what happened to his shoes or socks.

In addition to his injured foot, he says he got "a clout" on the left shoulder, and this caused him more pain than the foot. There was no bony injury in the shoulder region, nor was the skin broken, and the condition gradually cleared up without treatment. Probably he had sustained a tearing of a few muscle-fibres and an intramuscular hæmatoma—a very painful condition.

On Examination.—I saw the patient for the first time in the operating theatre, together with the X-ray pictures (*Figs.* 422, 423).

The astragalus was completely absent, and there was a fracture of the external malleolus.

On examination of the wound on the inner side of the foot, I found that all the tendons behind the internal malleolus were severed, as were also the posterior tibial vessels and nerve.

There was a lacerated wound on the outer surface of the ankle. I excised the skin margins, and entertained the idea of joining the severed tendons, etc., but as exploration proceeded, I realized that such a proceeding was useless. The foot was so severely damaged that even if, as was unlikely, it survived, the initial damage to vascular and neural structures would probably render it useless. I therefore performed an amputation 7 in. below the knee, which healed by first intention.

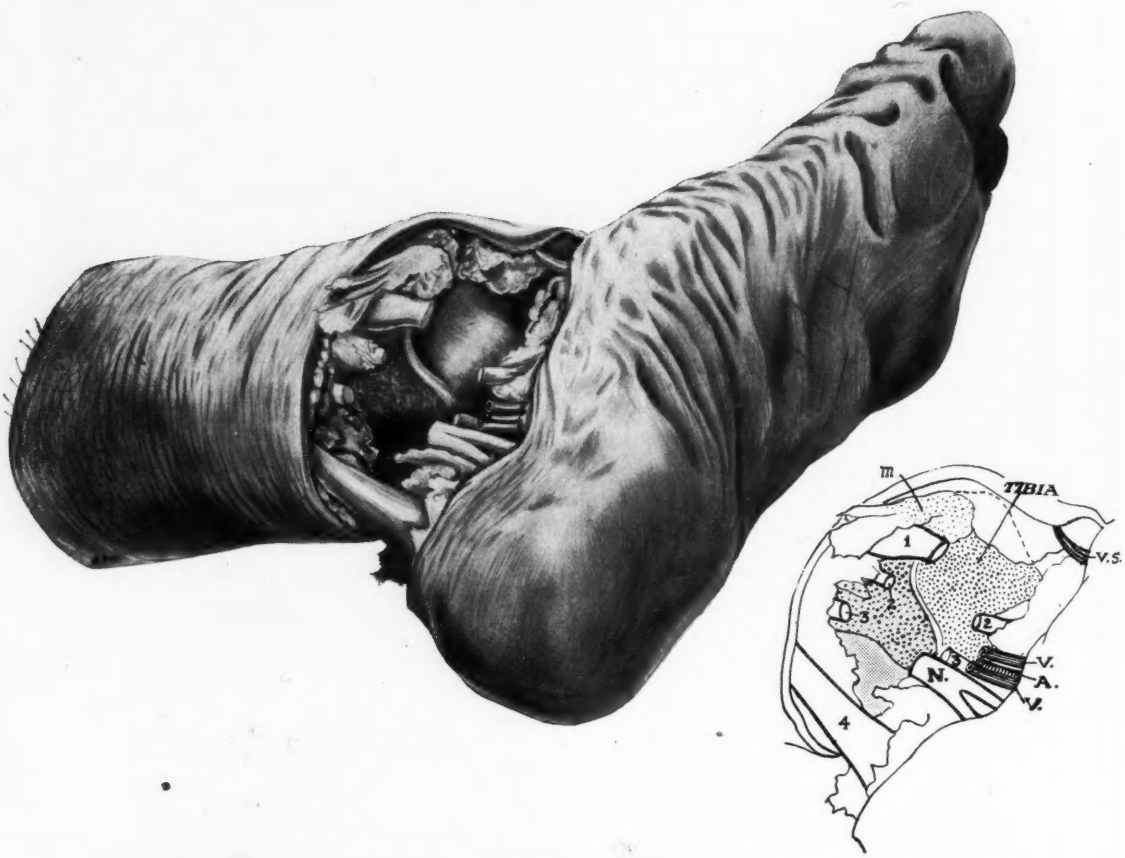


FIG. 424.—Drawing of the specimen. *Inset*, Key drawing: Tibia, the line points to the tibial inferior articular surface; M, Medial malleolus; V.S., Great saphenous vein; V., A., V., Posterior tibial vessels; N, Posterior tibial nerve, about to divide.
1, Ruptured tendon of M. tibialis anticus; 2, 2, Tendon of M. flexor longus digitorum; 3, 3, Tendon of M. flexor longus halucis; 4, Tendon Achilles.

THE SPECIMEN (*Fig.* 424).—The specimen is now in the Museum of the Royal College of Surgeons, and is the first specimen of the present war to be placed there. I am indebted to Dr. A. J. E. Cave, Assistant Conservator of the Museum of the Royal College of Surgeons of England, for the following description:—

The left foot of an adult male attached to the amputated lower part of the corresponding leg and severely traumatized in the region of the ankle-joint. The astragalus is missing, and the fibula is horizontally fractured immediately above its malleolus. About the level of the ankle-joint the skin and subcutaneous tissues are torn in a continuous elliptical gash,*

* The two wounds at operation had been joined by removing the narrow bridge of skin between them when excising the skin edges.

extending from the scaphoid tuberosity medially, above the insertion of the tendo Achillis posteriorly to the region of the fibular malleolus laterally.

On each aspect of the foot the deeper ligamentous, musculo-tendinous, and osseous structures are exposed, and the disorganized ankle-joint is in free communication with the exterior.

The tibial malleolus projects freely through the divided subcutaneous tissues and skin, and adherent to it are the remnants of the ligamentum laciniatum superficially and of the deltoid and capsular ligaments more deeply. In front of the bone the beginning of the V. saphena magna appears intact in the wound : the M. tibialis anticus is not visible. Behind and in contact with the malleolus lies the ruptured tendon of the M. tibialis posticus, traumatically divided in its passage from leg to foot. On a deeper plane lie the tendons of the Mm. flexor digitorum longus and flexor longus hallucis, both ruptured at the junction of their muscular and tendinous portions. The posterior tibial vessels have been likewise traumatically severed close to their termination. The posterior tibial nerve has been torn immediately above its division into its medial and lateral plantar moieties. The tendo Achillis remains intact : a distinct M. plantaris tendon is not discernible.

Both direct visual inspection and digital examination confirm the radiographic finding of total absence of the astragalus. Within the wound, the exploring finger encounters the inferior articular surface of the tibia, the posterior (astragalar) surface of the scaphoid, the anterior, middle, and posterior astragalar facets of the calcaneus, the upper aspect of the spring (inferior calcaneo-scaphoid) ligament, the torn stump of the interosseous (talo-calcaneal) ligament, and the torn remnants of the capsular, deltoid, and other ligaments.

The lateral aspect of the specimen reveals a fracture of the fibular shaft just above the malleolus. The adjacent lateral edge of the inferior articular surface of the tibia is also somewhat chipped : the anterior and posterior talo-fibular ligaments are ruptured, though the dorsal talo-navicular remains intact. The undamaged tendons of Mm. peroneus longus and brevis retain their customary position behind the lower end of the fibula ; the lower muscular portions of these muscles are, however, somewhat lacerated.

Diagnosis.—Compound, complicated fracture-dislocation of the ankle-joint, with propulsion to the exterior of the entire astragalus.

Mechanism of the Injury.—The anatomical findings suggest that, at the time of injury, force was so applied to the limb as to displace the foot violently in a lateral direction, with a consequent fracture of the fibular shaft and a stretching and bursting of the tendinous, ligamentous, and cutaneous structures on the medial side of the foot. Rupture of the interosseous, capsular, talo-navicular, and other ligaments facilitated the bodily detachment of the astragalus from its ' bed ', this bone being propelled medially through the deeper tissues and the split skin, and emerging through them in front of the tibial malleolus.

DISCUSSION

Dislocations of the astragalus have been described by many authors, but I have encountered one description only of the astragalus being forced out through the skin. In this case, described by M. C. and J. L. Collins,[1] the astragalus was found lying between the skin and the patient's sock. After cleaning the wound and the astragalus they replaced the bone in the patient's foot, and obtained a very satisfactory result.

Sneed[2] had previously removed an astragalus from under the skin, cleaned it, and replaced it in its proper place, and he also got a good result.

Mitchell,[3] in describing a case, refers to the mechanism of dislocation as follows : " The shoe heel caught on the step. As the patient fell forward, the foot was forced into strong plantar flexion, thus widening the anterior aspect of the joint. At the same time, pressure from the weight of the body was exerted on the astragalus from above and behind. In this manner the astragalus was presumably squeezed from its position as a pea is squeezed from a pod."

Bonnin,[4] in a recent full account of dislocations published in this JOURNAL, states that in this condition " the incidence is highest in young males. In children the leg

breaks before the necessary force to dislocate the talus is developed, and in the old the calcaneus collapses." He stated that a fall from a height on to the feet is the commonest cause, and that antero-lateral dislocation is the commonest variety. In the case here reported it is impossible to state exactly what happened, but instead of a fall from a height the force was exerted from below by the explosion, and the astragalus appears to have been forced out of the foot by a rupture of the structures on the inner side of the ankle.

Interesting features of the case are: the reversed direction of the force usually required to produce this type of injury; the extensive rupturing of the soft tissues, with expulsion of the astragalus; the rupture of important vessels without loss of blood great enough to have rendered the patient obviously exsanguinated; and, finally, the providential rescue from the sea of this wounded man who could not swim.

REFERENCES

[1] COLLINS, M. C., and COLLINS, J. L., *Calif. and Western Med.*, 1939, **51**, 39.
[2] SNEED, W. L., *Jour. Bone and Joint Surg.*, 1925, **7**, 384.
[3] MITCHELL, J. I., *Ibid.*, 1936, **18**, 212.
[4] BONNIN, J. G., *Brit. Jour. Surg.*, 1940, **28**, 88.

CRITICAL REVIEW

CURRENT PRACTICE IN ANÆSTHESIA AND ANALGESIA

By C. LANGTON HEWER

ANÆSTHETIST, EMERGENCY MEDICAL SERVICE; SENIOR ANÆSTHETIST, ST. BARTHOLOMEW'S HOSPITAL; ETC.

THE scope of anæsthesia and analgesia is so vast that it is only possible in this article to give a brief outline of some aspects of current practice.

PREPARATION OF THE PATIENT

It is now generally agreed that, before operation, a patient should approximate to his normal condition as closely as possible. The former practice of excessive purging, starvation, and enemata is most detrimental, since it tends to produce dehydration and ketosis. Apart from abdominal operations, it is only necessary that the stomach and rectum should be empty. If there is time and opportunity, glucose or sodium lactate should be given, as it has been shown that 'starved' liver cells are more susceptible to the toxic effects of narcotics than those which are laden with glycogen. In casualty work, it is essential to treat existing shock efficiently before proceeding to operate. The neglect of this precaution has led to some avoidable fatalities.

PREMEDICATION

Drugs are given before operation with two main objects in view. The first of these is to diminish sweating and the secretion of saliva and mucus promoted by respiratory irritants such as ether. *Atropine* is the drug usually employed for this purpose and should be injected hypodermically in full dosage at least half an hour before operation. In cases of great urgency, a slightly smaller dose can be given intravenously. It should be noted that children require relatively large amounts of atropine: for example, babies can be given $\frac{1}{200}$ gr. with good results. Conflicting views are held on the prophylactic effect of atropine on primary cardiac failure with chloroform. While the drug has no action on the prevention of ventricular fibrillation, which is probably the commonest mechanism of cardiac failure, animal experiments support the view that it may protect against vagal stimulation. Atropine should not be given to patients suffering from severe toxic goitre as it may increase the tachycardia.

The second object of premedication is the mitigation of pre-operative fear. This can be accomplished either by sedation or by full basal narcosis.

Sedation.—It is here the anæsthetist's object to get the patient into a pleasantly drowsy, unemotional, and amnesic state. The common drugs used for this purpose are morphine (or its derivatives) and scopolamine. In the latter case the pure lævo-rotatory alkaloid should be used, as impure scopolamine can cause excitement.

The drug has a similar effect to atropine in drying up secretions and also produces amnesia. Many anæsthetists use a combination of morphine (or omnopon) and scopolamine only, but both these drugs are respiratory depressants and tend to prolong the induction of inhalational anæsthesia. The writer prefers the addition of a *small* dose of atropine just sufficient to counteract the respiratory depression without diminishing the narcotic effects of the other drugs. The preparations known as 'Hyoscine compounds A and B' fulfil these requirements admirably and patients usually have no recollection of having been moved from their beds. Administration should be by the hypodermic route about forty minutes before operation. If time is short a slightly smaller dose can be given into a vein.

Basal Narcosis.—In this condition the patient is rendered completely unconscious, preferably in his bed. A large number of drugs are used for this purpose and the oral, rectal, or intravenous route can be employed.

Paraldehyde is usually given per rectum in a 10 per cent solution in warm water about three-quarters of an hour before operation. The average dose is 1 drachm of the pure drug for each stone of the patient's weight, but 8 drachms is rarely exceeded. In the writer's view, paraldehyde is the safest basal narcotic at present known and causes the least fall in blood-pressure and the least respiratory depression for a given level of narcosis. The only disadvantage is the somewhat unpleasant smell due to partial excretion of the drug by the lungs. Paraldehyde is of great use in nervous children before tonsillectomy, etc. It can be given by the child's own nurse, and as a rule the patient has no idea that he has had an operation.

Avertin fluid (syn., bromethol) is tribromethyl alcohol in amylene hydrate and is given per rectum as a warm 2·5 per cent solution in distilled water. The fluid must remain orange-red after a few drops of Congo red have been added as an indicator. The dose varies with the degree of narcosis desired and with the patient's basal metabolic rate. For example, in obstetrics the usual dose is 0·075 c.c. per kilo body-weight and in a severe case of toxic goitre or in children it may be as high as 0·12 c.c. per kilo. Avertin has little odour, but causes a considerable fall in blood-pressure and respiratory depression.

Barbiturates.—The 'medium' barbiturates such as nembutal, pernocton, seconal, sodium hebaral, and sodium soneryl are suitable for basal narcosis. Most of these drugs can be given by mouth in capsule form about 1½ hours before operation, but unfortunately their effects are extremely variable, and if full basal narcosis is imperative, the intravenous route must be used. Here the dose is empirical, the solution being injected at the rate of about 1 c.c. per minute until consciousness is just lost.

The short-acting barbiturates, such as evipan sodium and pentothal sodium, can be used for the induction of anæsthesia in patients who dislike a face-piece, but they are not so suitable for basal narcosis in bed as their evanescent effect tends to wear off during the journey to the operating theatre. Some prolongation of action can be obtained by injecting a somewhat larger dose *slowly*, but even so the period of unconsciousness cannot be relied upon to exceed 10–15 minutes. In order to overcome this difficulty, the rectal route has been tried with some success. If a 10 per cent solution of evipan or pentothal sodium is used, the usual rectal dose is 0·2 c.c. per pound body-weight, or 1 g. of the pure drug per 50 lb. The volume of fluid being small, retention is easier than with paraldehyde or avertin.

Since the barbiturates have an action antagonistic to that of cocaine and its derivatives, they can usefully be employed for premedication prior to local analgesia.

INHALATIONAL ANÆSTHESIA

The volatile anæsthetics in common use for inhalation are six in number and can be arranged in a definite order, as in the appended table.

Table I.—INHALATION ANÆSTHETICS AND THEIR PROPERTIES

ANÆSTHETIC AGENT	CHEMICAL FORMULA	BOILING-POINT (C.)	TOXICITY	DEGREE OF MUSCULAR RELAXATION OBTAINABLE	RATE OF ELIMINATION	INFLAMMABILITY	VAPOUR DENSITY
Nitrous oxide	N_2O	− 150°	Practically nil apart from anoxia	Practically nil apart from adequate premedication	Practically equal to that of its absorption	−	1·5
Cyclopropane	$H_2C{-}CH_2$ $\vee$ CH_2	− 35°	Slight apart from respiratory depression	Variable	Rapid	+	1·5
Ethyl chloride	C_2H_5Cl	+ 12·5°	Slight	Variable	Rapid	+	2·2
Di-vinyl ether	$O<^{C_2H_3}_{C_2H_3}$	+ 28·3°	Moderate	Variable	Rapid	+	2·4
Di-ethyl ether	$O<^{C_2H_5}_{C_2H_5}$	+ 34·6°	Moderate. Irritant to respiratory passages	Good	Slow	+	2·6
Chloroform	$CHCl_3$	+ 61°	High, particularly to cardiac mechanism	Very good	Very slow	−	4·0

Modified from *Recent Advances in Anæsthesia and Analgesia*, 3rd ed., J. & A. Churchill.

It will be observed that the same order holds good for the vapour densities and the boiling-points, the first three agents being gases at ordinary temperatures and pressures, while the remainder are liquids. It follows that their rate of elimination becomes progressively slower. All these drugs act by limiting the process of oxidation of the cortical cells, and, without going into the theory of general anæsthesia, it can be said that they accomplish this in a progressively toxic and potent manner. It is thus a regrettable fact that the more perfect is the anæsthesia the more toxic is the drug producing it. Thus in the extreme case of chloroform, death can be produced in at least three different ways, viz., by primary cardiac failure, by overdosage causing respiratory and secondary cardiac failure, and finally by acute yellow atrophy of the liver. Apart from the possibility of a fatal issue, a prolonged anæsthesia with chloroform induces a grave metabolic upset, as evidenced by leucocytosis, hyperglycæmia, raised blood-urea and blood-cholesterol values, albuminuria, and acetonuria.

It follows from these considerations that it is essential to select the least toxic drug or combination of drugs to produce the required depth of anæsthesia, and this can usually be best accomplished by using adequate premedication and N_2O–O_2 anæsthesia. The necessary degree of muscular relaxation is obtained either by adding minimal quantities of such drugs as ether or chloroform or by suitable field and nerve blocking.

A few words must now be said about individual agents and the techniques for administering them.

Nitrous Oxide.—Before the war, considerable research had been carried out on the composition of storage cylinders and a very light and strong steel alloy containing nickel, chromium, and molybdenum had been evolved. The resulting cylinders were a great improvement over the former heavy ones made of carbon steel. Nitrous oxide can be given with either air or oxygen.

Nitrous Oxide and Air.—This can be used to produce general analgesia or general anæsthesia.

Analgesia is usually induced by means of an intermittent flow apparatus which on inspiration delivers a mixture of about 45 per cent N_2O in air. The method is thus suitable for self-administration with sealed machines, as anæsthesia cannot be produced. The usual fields for this technique are in dentistry and obstetrics, but in the writer's opinion it could profitably be extended in many directions such as for painful dressings, etc. If used with discretion gas analgesia is quite innocuous and after-effects are rare.

Anæsthesia with nitrous oxide and air can be produced with a simple apparatus, and is extremely useful for short operations in adults in which complete muscular relaxation is unnecessary. In dentistry a nasal inhaler is substituted for a face-piece, and considerable gas pressure may be necessary in mouth-breathers to avoid air dilution. No other method affords such freedom from after-effects, and for out-patient clinics it is invaluable. A certain degree of asphyxia being unavoidable, gas and air should not be used for young children or for patients suffering from respiratory obstruction or from uncompensated cardiac disease.

Nitrous Oxide and Oxygen.—This is suitable for narcosis of any duration, but its limitations must be realized. In the average healthy patient adequate premedication is essential, and if complete muscular relaxation is required some adjuvant must be added to the mixed gases or some local block combined with the inhalation.

The American practice of obtaining relaxation by ' secondary saturation ' has little to commend it and is probably the cause of some of the post-anæsthetic cerebral complications which appear to be fairly common in the United States but are practically unknown in this country. At this point it might be mentioned that some surgeons still object to any cyanosis occurring during gas-oxygen anæsthesia. It is now well-recognized that cyanosis need not imply anoxia and is simply an indication of the amount of reduced hæmoglobin present. It may be impossible to produce cyanosis in an anæmic patient and impossible to avoid it in a plethoric one.

Apparatus working on one of three principles is used for the administration of nitrous oxide and oxygen :—

1. The *continuous flow system* with partial re-breathing. The volume of gases passing per minute is measured by means of wet or dry flow meters.

2. The *intermittent flow system* with either partial or no re-breathing. In this case the gases only flow during inspiration, and their percentage, but not their volume is measured. The pressure of the gases can be varied within wide limits without upsetting the mixture and this feature is of much service in thoracic surgery and in dentistry.

3. The *closed circuit system* with complete re-breathing. Since anæsthetic gases are exhaled unchanged they can be re-inhaled indefinitely. It will be obvious,

however, that in a completely closed system the carbon dioxide will gradually accumulate while the oxygen percentage will fall. This is avoided by a CO_2 absorber (usually containing non-hygroscopic soda-lime) and the addition of a small quantity of oxygen which will vary with the patient's basal metabolic rate and is consequently known as the ' basal oxygen flow '. Almost any type of gas-oxygen apparatus can be converted to the closed-circuit principle, but it is necessary to have an accurate flow meter to measure the ' basal oxygen '. A vaned duralumin bobbin rotating within a glass tube is generally used for this purpose and is accurate to within $\pm$ 2 per cent.

The simplest closed circuit has the absorber quite close to the face-piece, the patient breathing in and out through it to a re-breathing bag. This ' single-phase ' system is very efficient, but the absorber is in an awkward position and tends to heat the respired gases unduly.

An alternative closed circuit is the ' two-phase ' system with the absorber on the gas-oxygen machine and connected to the face-piece by two corrugated rubber tubes. Unidirectional valves ensure that the patient breathes in through one tube and out through the other. The two phases of inspiration and expiration are thus kept separate by the valves. This system is very convenient, but is not quite so efficient as the single-phase one, while the friction of the valves adds slightly to the respiratory effort.

In the writer's opinion, the adoption of the closed-circuit principle marked one of the greatest advances in modern anæsthesia. Its advantages include: (1) the confinement of anæsthetic vapours so that no odours or inflammable gases escape into the atmosphere; (2) diminution of the patient's heat and water-vapour loss through respiration; (3) quiet breathing from lack of CO_2 in the inspired gases; (4) great economy in gas consumption.

Ethylene and Acetylene.—These are unsaturated inflammable hydrocarbon gases and at one time had considerable vogue as anæsthetics in America and Germany respectively. As they never attained popularity in the United Kingdom, they need not be considered further.

Cyclopropane.—This gas has been introduced into anæsthesia comparatively recently, but its remarkable properties have shown it to be of great service in certain types of operations. Cyclopropane is inflammable and is of much greater potency than nitrous oxide, a proportion of 15 per cent in the inspired mixture usually producing deep anæsthesia. The gas does not irritate mucous membranes and tends to depress respiration. For these reasons cyclopropane is most suitable for major thoracic surgery. In severely handicapped patients, e.g., in total thyroidectomy for uncompensated cardiac disease, a very high oxygen percentage can be used, but the modern tendency is to employ a moderate proportion of oxygen and to make up the balance with nitrogen (from air). In this way less disturbance occurs at the end of anæsthesia when normal oxygen concentration is resumed. It has recently been shown that cardiac irregularities are less common if cyclopropane is preceded by one of the barbiturates instead of by morphine. Owing to its high cost, the gas is always given by the closed-circuit method already mentioned. From experience gained during the present war, cyclopropane seems to be of great use when an immediate operation must be performed in the presence of severe shock.

Ethyl Chloride.—The use of this agent is practically confined to the ' single dose ' technique for short operations in children such as dental extractions and

guillotine tonsillectomy. The open method is preferable to the closed one, since laryngeal and masseteric spasm are less likely to occur. A change-over to open ether can be made if a longer operation is to be performed.

Di-vinyl Ether.—The commercial product known as ' vinesthene ' has come into use comparatively recently and is tending to displace ethyl chloride for short operations, especially in out-patients, since post-anæsthetic nausea and vomiting are singularly uncommon. Vinyl ether appears to have no effect upon uterine contractions, a fact of service in obstetric practice. The vapour is more potent but less irritating than that of di-ethyl ether. For continuous anæsthesia the drug is usually added in very small amounts to a N_2O–O_2 mixture by means of a drip vaporizer. Good muscular relaxation can usually, but not always, be obtained by this means.

' Vinesthene anæsthetic mixture ' contains 75 per cent ethyl ether and 25 per cent vinyl ether. It resembles a C.E. mixture in its action and in the ways in which it can be given, but has the great advantage that the risk of primary cardiac failure is absent.

Di-ethyl Ether.—After nearly a century's use, ethyl ether still remains the standby of the occasional anæsthetist. Excellent muscular relaxation is obtainable easily, and there is a wide safety margin. While these two advantages are undeniable, ether is a toxic drug and post-anæsthetic morbidity may be evidenced by vomiting, ketosis, and pulmonary complications. Recent work on the latter condition suggests that ether, like alcohol, diminishes tissue resistance to pneumococci and other organisms, besides being an irritant vapour. It is clear that the smallest possible amount of ether should be used to produce the required depth of narcosis and this can be done by adding minimal quantities to an N_2O-O_2 mixture instead of employing it alone. If, for any reason, it does become necessary to use large doses of ether, it should be given as a warmed vapour rather than as a cold liquid on an open mask, and 10 per cent CO_2 should be used for a short time at the end of anæsthesia to deepen respiration and increase elimination of ether. A small dose of insulin diminishes post-anæsthetic hyperglycæmia and ketosis. The cause of the rare complication known as ' late ether convulsions ' still remains obscure, but the treatment of *cautiously* injecting a quick-acting barbiturate into a vein is usually successful.

Chloroform.—The various ways in which this drug can cause toxic symptoms have already been mentioned and they are now so well recognized that the use of chloroform is confined to a few conditions only. Owing to the fact that chloroform vapour is not inflammable or irritating it is sometimes added to N_2O-O_2 mixtures in thoracic surgery, in patients suffering from respiratory obstruction and pulmonary diseases, and for operations involving the use of the diathermy cautery in or near the air-passages. The fact that parturient women are less likely to exhibit primary cardiac failure during light chloroform anæsthesia than other patients has still not been satisfactorily explained, but even in the field of obstetrics the drug is being ousted by other and less toxic agents.

NON-NARCOTIC GASES USED IN ANÆSTHESIA

Carbon Dioxide.—This gas is employed mainly for its stimulating effect upon respiration. Thus at the conclusion of a tedious operation upon the upper abdomen, a few minutes' use of a 10 per cent CO_2 mixture will expand the bases

of the lungs and will hasten the rate of elimination of the volatile anæsthetic used. The addition of the gas to the inspired mixture also widens the glottic opening and is useful before intubation. There is no doubt that abuse of CO_2 has often occurred, and in these circumstances it may do more harm than good.

Helium.—This element is the lightest non-inflammable gas known and because of its low density will ' thin ' anæsthetic mixtures. It may be of great service in acute respiratory obstruction until the cause can be removed. For example, it may be possible to induce anæsthesia safely in a patient suffering from an obstructive goitre by means of a cyclopropane-helium-oxygen mixture.

ENDOTRACHEAL ANÆSTHESIA

All the volatile anæsthetic agents already mentioned can be delivered through a tracheal tube instead of by a face-piece or nose-piece. The original insufflation technique was introduced prior to the 1914–8 war and consisted in forcing the anæsthetic vapours through a narrow semi-rigid catheter, the return flow taking place between this catheter and the glottis or through a rubber return tube. This method has been practically abandoned for several reasons, the chief one being that it is unphysiological, as the alveolar CO_2 tension falls.

In the modern inhalation technique, the largest rubber tube that will pass through the glottis easily is used, and inspiration and expiration take place through it. In order to secure a water-tight seal, a pharyngeal pack of gauze soaked in a vegetable oil can be used, but post-operative pharyngitis is greatly reduced by omitting the pack and substituting a special tracheal tube fitted with an inflatable cuff. A pilot balloon indicates the degree of inflation and gives warning of puncture. Such tubes are difficult to pass ' blindly ' through the nose, but for most prolonged operations oral intubation by direct vision laryngoscopy can be performed.

Endotracheal anæsthesia is indicated whenever respiratory obstruction may be anticipated either from the nature of the operation or disease (e.g., obstructive goitre), the position of the patient (e.g., excision of cerebellar tumour), or the possibility of ingress of fluids to the air-passages (e.g., intestinal obstruction). The method is also often used for major surgery of the upper abdomen if local blocks are not employed. A modified insufflation technique will give extremely shallow respiration and ' abdominal silence ' equal to that obtained by spinal block.

Some anæsthetists use the endotracheal method for toxic goitre operations, but observations upon about 3000 such cases have convinced the writer that the combination of avertin (or paraldehyde), local infiltration, and N_2O-O_2 results in less tracheitis and a shorter convalescence.

Various adaptations of endotracheal anæsthesia are used in thoracic surgery and tracheal secretions can be removed by means of a suction catheter passed down the lumen of the tracheal tube.

' Controlled respiration ' is facilitated by the use of endotracheal cyclopropane, although the technique is not essential. At this point a few words might be said about a subject which has been made unnecessarily involved. From certain Continental articles one might imagine that some complicated apparatus such as a ' spiro-pulsator ' was necessary for this procedure. In actual fact ' controlled respiration ' is merely the initial production of acapnia and thereafter the control of the respiratory movements by some such simple process as compressing the re-breathing bag. The acapnia is generally produced by: (1) rendering the

respiratory centre less sensitive to the normal CO_2 stimulus by such depressants as morphine and cyclopropane; or (2) lowering the CO_2 tension in the blood by augmenting the depth of natural respiration with a closed circuit and CO_2 absorber; or (3) a combination of the two methods.

Controlled respiration is of use if one or both pleural cavities are open, as it prevents paradoxical respiration and mediastinal flap. At the same time it is the writer's opinion that slight positive pressure is, as a rule, preferable to controlled respiration. The original assertion that the CO_2 tension rises to a dangerously high level with an open pleura has not been borne out by subsequent investigation, and even if it had, it is doubtful whether the alkalosis induced by controlled respiration is any less harmful.

INTRAVENOUS ANÆSTHESIA

At first sight the intravenous route would seem the obvious one by which to introduce anæsthetic drugs, as they are carried by the blood-stream direct to the cerebral cortex and their dose can be regulated with absolute precision. The chief disadvantage lies in the fact that elimination of the barbiturates does not take place through the lungs but by 'detoxication' in the liver and excretion by the kidneys, processes the rate of which cannot be modified. It follows that the treatment of overdosage is difficult and is practically confined to maintaining respiratory exchange by rhythmic inflation of the lungs with oxygen, and to maintaining the blood-pressure by the intravenous administration of analeptics.

Drugs Employed.—In the past many intravenous anæsthetics have been tried, but at the present time the short-acting barbiturates are employed almost exclusively. The commonest members of the group in regular use in this country are evipan sodium (soluble hexobarbitone), narconumal, sodium thioethamyl (venesetic), pentothal sodium, and eunarcon. The first two drugs are used in a freshly dissolved 10 per cent solution, the third as a 7·5 per cent solution, and pentothal as a 5 per cent solution. Eunarcon is relatively stable and can be used direct from ampoules. The 'safety factor', or ratio of the minimal lethal dose to the minimal anæsthetic dose, has been estimated in animals to vary from 2·3 in the case of pentothal to 4·0 for narconumal.

Techniques.—The 'single-dose' method can be used if only one person is available to perform a minor operation and to give the anæsthetic. Even so, a nurse or other helper must be available to keep the jaw forward or to insert an artificial airway as required.

In the 'repeated dose' technique, a separate anæsthetist is essential. The needle is kept in the vein and just enough solution is injected from time to time to abolish reflex movements. A more level plane of anæsthesia can be obtained than with the first method, and at no time should grave respiratory or circulatory depression occur.

Prolonged operations can be performed under 'continuous' intravenous anæsthesia. In this case the drug is added to a glucose-saline infusion either through a drip-feed or a two-way syringe. This method can also be combined with an N_2O-O_2 inhalation, the barbiturate being used as an adjuvant instead of chloroform or ether.

Indications.—Intravenous anæsthesia is chiefly employed for producing a short narcosis in conditions where inhalational methods are inapplicable or inconvenient.

Since good muscular relaxation can usually be obtained, the reduction of dislocations and the setting of fractures can be performed. The method is also particularly useful for minor operations about the face or mouth, for procedures involving the use of the diathermic cautery, and in patients suffering from chronic respiratory diseases. Examinations such as cystoscopy, sigmoidoscopy, and œsophagoscopy can readily be done, but the method is unsuitable for bronchoscopy unless careful preliminary cocainization is performed, since the laryngeal reflex persists. The intravenous barbiturates cannot be regarded as complete substitutes for nitrous oxide, since after-effects are more likely to occur and out-patients should not be allowed to go home alone or to drive a car the same day. Opinions differ as to the propriety of using the method for prolonged operations, but there is no doubt that the toxicity of the drugs increases with the length of narcosis. The use of intravenous drugs as a preliminary to inhalational anæsthesia has been mentioned under ' premedication '.

Contra-indications.—From a consideration of the action of barbiturates it is obvious that intravenous anæsthesia should not be used for patients who are very toxæmic or jaundiced or suffering from severe nephritis. The method is also unsuitable in acute respiratory obstruction, uncompensated heart lesions, severe shock, and acute suppurative inflammations of the throat.

One sees from time to time in medical journals denials that one or other of these conditions are really contra-indications, from histories of patients who apparently suffered no ill-effects from intravenous anæsthesia. Such an argument is on a par with citing a case of acute appendicitis which recovered spontaneously as a plea for abolishing appendicectomy.

LOCAL ANALGESIA

Local analgesia covers every method of rendering a limited area of the body insensitive to pain.

The prolonged and sometimes acrimonious arguments on local versus general anæsthesia, appear to the writer to be both futile and unnecessary. The two methods should be complementary and not antagonistic. Over twenty years ago Crile, in developing his ' anoci-association ' theory, demonstrated that an operation produced the least possible trauma to the organism if psychic shock was avoided by unconsciousness and if traumatic impulses were prevented from reaching the central nervous system by infiltration or nerve or field blocking. This view has proved to be sound, and in the opinion of the writer the ideal technique for many major operations is the combination of adequate premedication, inhalation of nitrous oxide or cyclopropane, and suitable local analgesia.

The enthusiasts of purely local methods often point to famous Continental clinics where this technique is used. The writer has visited some of these and has not been impressed by the practice. The chief reason it is employed seems to be the crude and badly given open ether method which is the only alternative. One very well-known abdominal surgeon who is an exponent of pure local analgesia, has said that he would prefer to use general anæsthesia if he could secure a standard equal to that obtaining in British teaching hospitals. The occurrence of psychic shock during local analgesia can be demonstrated by the fact that if a general anæsthetic is superimposed, the pulse-rate usually falls and the blood-pressure rises

even if the patient has shown no obvious physical or mental distress. In this country the majority of patients prefer to be unconscious not only during a major operation but for some time before and after it. During a period of some years the writer questioned patients at a hospital where about half the thoracic operations were performed under general anæsthesia and half under purely local methods. A proportion of 65 per cent preferred general anæsthesia, and there is little doubt that in private practice the percentage would be still higher. It must be remembered that while pain is abolished, local analgesia alone does not prevent sensations of pressure, traction, and the like, while the discomfort of lying for a long time in a cramped position on an operating table must be experienced to be believed.

Indications.—Local analgesia can be used alone for many minor operations and examinations when it is inadvisable for the patient to lose consciousness; e.g., if he has had a recent meal, if he wishes to travel immediately afterwards, or if no anæsthetist is available. In major surgery the method is often used in combination with light general anæsthesia in order to secure complete muscular relaxation without recourse to toxic narcotics, to diminish capillary oozing in vascular areas, and to minimize 'reflex' shock.

Contra-indications.—Local analgesia should, as a rule, be avoided in children (apart from young babies) and where the injection would have to be made through septic areas or scar tissue. It should be noted that antiseptics added to injected solutions afford no protection against the spread of infection. It is also inadvisable to inject any vasoconstrictive solution in patients suffering from vasomotor or trophic disturbances.

Techniques.—

1. *Surface or Permeation Analgesia.*—Solutions of cocaine, pantocaine, or percaine can be applied to mucous membranes in order to render them insensitive. The eyes, nose, larynx, and urethra can be treated in this way. By means of the 'novocain pack', lacerated wounds can be sutured painlessly. Freezing methods are ineffective except for very minor procedures, and the subsequent thawing of the tissues may be extremely painful.

2. *Infiltration.*—The nerve-endings at the site of operation are paralysed by the injection of some such solution as 0·5 per cent novocain and 1–500,000 adrenaline. In thyrotoxicosis 1–50,000 cobefrin can be substituted for the adrenaline with a view to minimizing tachycardia. If a prolonged analgesia is desirable the best combination in the writer's experience is 0·25 per cent novocain with 1–2000 pantocaine (decicain). If the solution is coloured with a dye such as indigocarmine, the limits of the infiltrated area can readily be seen. Large areas can be covered more quickly if a continuous-flow syringe is used. The hæmatoma-injection method is a modification of infiltration and is useful in certain cases for setting fractures.

3. *Field-block.*—Walls of analgesic solution can be made to surround the operative field and will paralyse all nerves crossing them. This method can often be combined with infiltration.

4. *Nerve-block or Conduction Analgesia.*—This may be intraneural, i.e., the solution is injected within the nerve-sheath, when permanent analgesia is required. For example, the Gasserian ganglion can be injected with alcohol in cases of trigeminal neuralgia. For all ordinary purposes, however, a perineural injection is made outside the nerve-sheaths as in splanchnic or spinal block.

SPINAL ANALGESIA

This term covers all methods of paralysing several spinal nerve-roots simultaneously. The injections may be either extradural or subarachnoid.

The extradural method (epidural analgesia) has some vogue in Italy and America and can be effected by injecting between the spinous processes or into the sacral hiatus. The position of the needle can be estimated with some precision, since it has been shown that there is usually negative pressure in the peridural space. The needle is advanced until a 'hanging drop' from its proximal end is seen to be sucked inwards. This technique gives a more truly segmental type of analgesia than the subarachnoid one and there is less fall of blood-pressure, but unfortunately it is not so reliable.

In this country the term 'spinal analgesia' is usually taken to mean a subarachnoid block, where the injected solution mixes with the cerebrospinal fluid. A good deal of muddled thinking and writing has produced much confusion as to the various techniques, but actually there are only two possible alternatives. In health, cerebrospinal fluid has a specific gravity ranging from 1·004 to 1·010, that obtained by cisternal puncture being slightly lighter than lumbar fluid. It is therefore impossible to have a standardized *isobaric* solution, and it is dangerous to imagine that one is being used unless a preliminary test has been done. For example, 1 per cent pantocaine (decicain) has a sp. gr. of 1·0068 and may be either hyperbaric or hypobaric in any given case. The same holds good for Querella's 1–200 percaine (sp. gr. 1·006).

Most solutions are *hyperbaric*, since the drugs are comparatively weak and must be used in such concentration that the sp. gr. is brought up to a higher figure than 1·010. Of the various drugs available, the writer prefers 0·2 to 0·6 c.c. of 10 per cent stovaine (Chaput's formula) or 50–150 mg. novocain crystals dissolved in cerebrospinal fluid. If a more prolonged analgesia is necessary 1–2 c.c. 'heavy percaine' (1–200 in 6 per cent glucose) is usually satisfactory. The behaviour of hyperbaric solutions after injection can be visualized by imagining them to resemble a globule of mercury which will descend to the lowest point of the dural sac. A small dose injected in the sitting position will produce perineal analgesia, while unilateral effects can be produced by rather larger amounts given with the patient lying on his affected side. For a bilateral block up to the umbilicus the patient should be turned on to his back immediately the injection is completed.

This hyperbaric technique is quite satisfactory for low and medium blocks, but when a high level of analgesia is required the fall in blood-pressure may be severe owing to the greater number of paralysed anterior roots (in which run the vasomotor nerves). It is true that an analeptic such as ephedrine or neosynephrin hydrochloride given *some time before* the intrathecal injection minimizes the pressure drop to some extent, but the most rational method of avoiding it is the adoption of the Trendelenburg position. This cannot be done immediately after a hyperbaric injection or medullary paralysis may ensue, so the use of light solutions for high blocks was adopted. The first attempt at producing these was the addition of alcohol (with gliadin, etc.) to novocain solution, which resulted in *pseudo-hypobaric* mixtures such as 'spinocaine' and 'light duracaine'. By using coloured liquids in glass tubes it has been shown that although these solutions are hypobaric *in vitro*, when they are injected the alcohol diffuses very rapidly in the cerebrospinal fluid,

causing much turbulence, and the heavier constituents are left to spread by gravitational diffusion. The ultimate result is largely unpredictable.

The discovery of percaine made a true *hypobaric* solution practicable. This drug acts in such extreme dilutions that the sp. gr. of the solvent is not appreciably raised. 'Light percaine' (1–1500 in 0·5 per cent saline) has a sp. gr. of 1·0036 at 37° C., and when injected into cerebrospinal fluid assumes the shape of an elongated air bubble. The original Howard-Jones technique is sound and most satisfactory for bilateral blocks of the upper abdomen. Unilateral blocks can be obtained by injecting the solution with the patient's affected side uppermost, i.e., in the position of the subsequent operation. The writer has employed unilateral thoracic blocks for major thoracotomies on patients with excessive sputum and there is no doubt that less disturbance and fall in blood-pressure occurs than with equally high bilateral blocks.

It is difficult to give a list of the *indications* for spinal analgesia as there is probably no subject upon which the views of both surgeons and anæsthetists are more divergent. Some will never employ the method at all, while others use it on every possible occasion even for routine excision of the breast. It appears to the writer that spinal block can reasonable be given for most operations below the level of the diaphragm which are likely to cause shock or which require complete muscular relaxation for some time, particularly in patients suffering from, or liable to, pulmonary diseases. Suprapubic prostatectomy is frequently performed under this technique, but there seems to be a definite risk of reactionary hæmorrhage when the blood-pressure rises afterwards. Most patients suffering from acute intestinal obstruction are unsuitable subjects for spinal analgesia unless the obstruction is known to be non-mechanical, e.g., in paralytic ileus. Low blocks are useful for operations about the anus, perineum, and urethra, e.g., in perurethral prostatectomy. The results are more certain than the alternative extradural caudal and trans-sacral blocks. Unilateral high blocks are used by some anæsthetists for thoracic surgery in patients coughing up an excessive quantity of sputum.

Spinal analgesia has several *therapeutic uses*, the most recent being for gastro-intestinal achalasia, e.g., cardiospasm and congenital megacolon. In the writer's experience the ultimate results have been disappointing, although the immediate effect may be spectacular. Intrathecal absolute alcohol is also used for relieving pain due to inoperable growths. The injection is, of course, a hypobaric one and great care must be taken to see that the position for injection is correct, the solution being visualized as an air bubble. Even so, loss of sphincter control may occur.

Spinal analgesia also has a *diagnostic value*. For example, it can be used for patients suffering from thrombo-angiitis obliterans. A large rise in the foot temperature indicates a high degree of vasospasm and sympathectomy will probably be beneficial.

Attention has recently been paid to the *sequelæ* of spinal analgesia. While permanent paraplegia is fortunately extremely rare, transient lesions of the cauda equina are commoner than was formerly supposed. No credible explanation has yet been advanced of the squint which may begin about the third day and last for a few weeks. Headache remains the commonest complication, and while its cause is still obscure the treatment is now fairly satisfactory. It has been established that in true 'spinal headache' the cerebrospinal pressure as measured through a lumbar puncture needle is lower than normal. If possible, a 'head down' position

should be adopted and strongly hypertonic solutions can be administered per rectum or intravenously. In really severe cases, the intrathecal injection of warm normal saline is nearly always successful.

From the foregoing somewhat disjointed remarks, it will be apparent that the number of possible combinations and sequencies in anæsthesia is a very large one. The anæsthetist must not only be technically familiar with these, but must have the necessary clinical experience to decide which method is most suitable in any given set of circumstances.

The main interest of the subject, however, lies not so much in the achievements of the past as in its continual progress. As the surgeon evolves new operative techniques, so the anæsthetist must solve the hitherto unknown problems involved. This process has been well exemplified in thoracic surgery during the last decade.

Finally, it cannot be too often stressed that the surgeon and anæsthetist must be mutually sympathetic and work as a team if the best results are to be obtained.

SHORT NOTES OF RARE OR OBSCURE CASES

PROLAPSE AT THE UMBILICUS

By NILS L. ECKHOFF
ASSISTANT SURGEON, GUY'S HOSPITAL, LONDON

THE many antics of a persistent vitello-intestinal duct are well known. Abell points out that the duct may communicate with the umbilicus to form a fistula, or may become obliterated to form a fibrous cord. In this remnant the development of carcinoma, sarcoma, myoma, and cyst formation has been described. A diverticulum of the ileum alone may remain, which may be spherical, conical, bulbous, or finger-like. In the wall all the coats of the ileum are found, with Peyer's patches and crypts of Lieberkuhn. Pancreatic tissue and gastric mucosa may occur. Aschner and Karelitz record 33 cases with peptic ulcer in a diverticulum.

Obstruction, volvulus, intussusception, diverticulitis, peridiverticulitis, typhoid perforation, abscess formation, and peritonitis all occur, and the diverticulum may be found in a hernia. But of all these complications fæcal fistula is the most uncommon, and prolapse or intussusception through the umbilicus must be very rare indeed. In a short search of the literature I have only been able to find one similar case, that of Corner, quoted by Brennecke.

CASE REPORT

This child was admitted to Lewisham Hospital (L.C.C.) six hours after birth, on June 25, 1940. The parents were healthy and there were four other children, all healthy. Weight 5 lb. 12 oz.

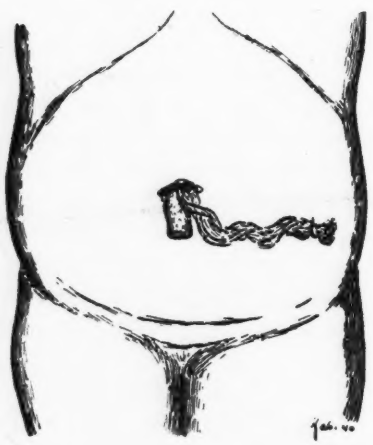


FIG. 425.—Condition at birth. Umbilical cord and persistent duct seen.

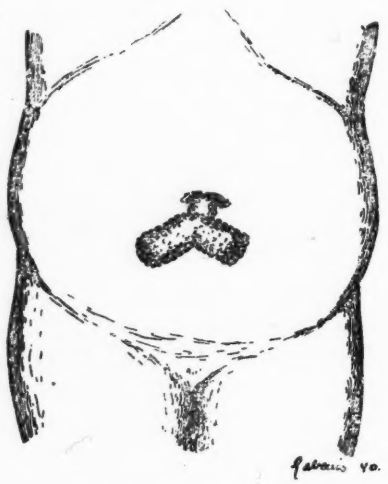
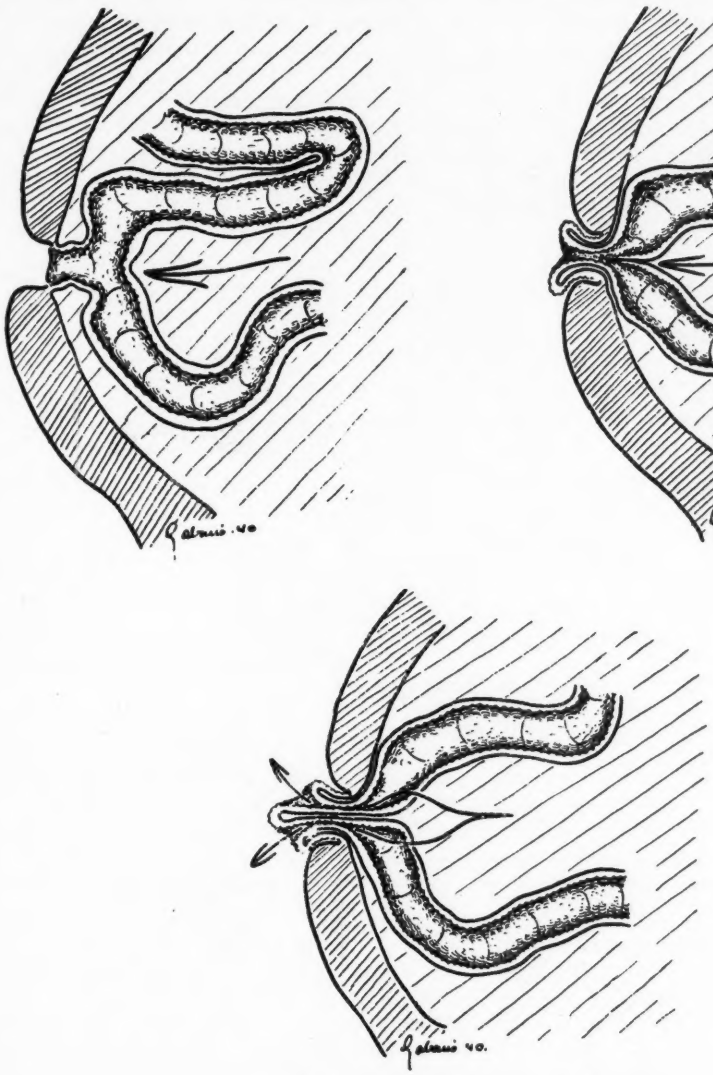


FIG. 426.—Condition 5th week. T-shaped prolapse from umbilicus.

The umbilical cord was noticed to be abnormal at birth, for alongside the normal cord carrying the vessels was a tubular structure about 2 in. long, resembling a piece of intestine (*Fig.* 425). The relation of these two structures to the amnion was not made out.

From the start meconium began to appear at the apex of the tubular structure, and all motions were passed through a small orifice here. It was clear that this was a patent



FIGS. 427–429.—Development of prolapse.

vitello-intestinal duct. The anus was normal. Radiographs taken at this stage revealed that barium taken by the mouth all passed out of the fistula, while lipiodol injected into the fistula passed into coils of small intestine, and rapidly entered the cæcum and large bowel; and barium per rectum passed round to a highly placed cæcum, and entered coils of small intestine.

Three days after birth the weight was 4 lb. 9 oz. At the suggestion of the Medical Superintendent, Dr. Nockolds, a catgut purse-string suture was tied around the projecting tube, and I first saw the child after this had been done. Most of the fæcal matter was now passed per rectum, but some greenish-yellow watery fluid occasionally appeared at the umbilical

orifice. The cord separated in the usual way on the tenth day, leaving a short tube, which had now somewhat shrunk in size. As the mother was anxious to take the child home to her family, she was allowed to do so, on the twentieth day, with instructions to return at once if fæcal matter appeared at the umbilicus. The weight of the child was now 5 lb. 6 oz., and it was considered quite unjustifiable to attempt to deal radically with the abnormality at this stage. The child was taking extracted breast-milk quite well.

Fifteen days later (at the age of 5 weeks) the child was brought back with a remarkable tumour presenting at the umbilicus (*Fig.* 426). This had first begun to appear some twelve hours before, accompanied by bleeding from the tumour, and it was regrettable that the mother had not brought the child back earlier. There was some excoriation of the skin of the abdominal wall from the occasional discharge of intestinal juices, but the stools had been passed in the ordinary way, until the time of appearance of the umbilical tumour. There was considerable shock, and the infant was considered too ill to be stripped for weighing, but appeared to have lost weight since discharge from hospital.

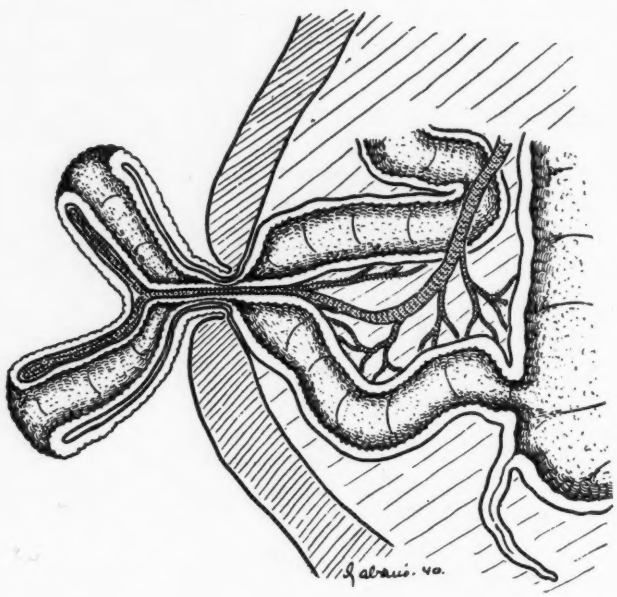


FIG. 430.—Fully developed condition with turgescence of evaginated loops.

The tumour was T-shaped, and covered outside by deeply injected mucous membrane, which bled at the touch. The vertical limb of the T was attached to the umbilicus, and at the end of each horizontal limb was an orifice leading into the lumen of the intestine. After a little thought it was possible to make out what had happened, and the accompanying diagrams attempt to explain this (*Figs.* 427–430). The patent duct presumably first turned inside out upon itself, and immediately dragged the proximal and distal loops of ileum up to the umbilicus. These then passed into the channel, and when they reached its extremity, the proximal passed to the left, and the distal to the right.

As gentle taxis produced no change in the appearance of the projecting mass, it was clear that operation was essential to effect reduction. Gas-oxygen anæsthesia was therefore administered by Dr. Wolfson, and a short incision made below the umbilicus. It was now possible to see the proximal and distal loops entering the intussusception, and while pressure on the mass did not alone produce any result, very gentle traction was applied to the two entering loops by my assistant (Dr. Dorling) to guide them back into their proper position, while pressure was maintained outside. When the reduction was complete a short open duct was revealed running to the umbilicus (*Fig.* 427) from the antimesenteric border of the ileum, with the remains of the primitive vitelline vessels still seen on its posterior aspect. This duct

was removed flush with the bowel, closed, and invaginated with interrupted catgut sutures. The small incision was then closed.

Owing to the poor condition of the child, and in spite of all measures taken to improve his fluid balance, he began to sink some twelve hours after the operation, and died at the end of thirty hours. At post-mortem examination the condition of the bowel was found to be quite satisfactory.

I am indebted to Dr. Allen Daley, Medical Officer of Health, London County Council, for permission to publish this case.

BIBLIOGRAPHY

ABELL, I., *Surg. Gynecol. and Obst.*, 1935, **60**, 370.
ASCHNER, P. W., and KARELITZ, S., *Ann. of Surg.*, 1930, **91**, 573.
BRENNECKE, H. A., *Surg. Gynecol. and Obst.*, 1913, **16**, 200.
DRUMMOND, HAMILTON, *Ibid.*, 656.
HERTZLER, A. E., and GIBSON, E. J., *Amer. Jour. Med. Sci.*, 1913, **146**, 365.
RICHTER, H. M., *Surg. Gynecol. and Obst.*, 1913, **2**, 668.

A CASE OF RETROPERITONEAL DERMOID CYST

BY SURGEON COMMANDER E. R. P. WILLIAMS, R.N.
SURGICAL SPECIALIST, R.N. HOSPITAL, HASLAR

RETROPERITONEAL dermoid cysts are uncommon and it is rarely that a correct diagnosis is made prior to operation. The case reported below is of interest because of the large size of the tumour and its lack of symptoms until just before admission of the patient to hospital.

CASE REPORT

HISTORY.—The patient, a youth of 18 years, was admitted to the Royal Naval Hospital, Haslar, on June 23, 1940, complaining of a dull aching pain in the lower abdomen. He stated that he had been quite well until 14 days before admission, when, following a " chill ", he experienced pain on micturition and frequency of urine (D/N = 9/3) which persisted up to the time of admission. His bowels had been open normally and there had been no nausea or vomiting, though for a week he had had no appetite. There was no other relevant history.

ON ADMISSION.—Temperature, pulse, and respirations were normal. Tongue clean and moist. General condition quite good.

There was a lower abdominal swelling extending up from the pubis to the umbilicus, with a prolongation to the left (*Fig.* 431). This was firm and cystic in consistency, quite smooth, and a little tender. It was partially resonant to percussion.

Per rectum a mass separate from the prostate could be felt depressing the anterior wall of the rectum and more or less filling the pelvis. It was not unduly tender.

There were no signs of pressure on vessels or nerves and there was no detectable ascites. A complete blood-count gave a normal result.

The patient was catheterized and a few c.c. only of clear urine were obtained, which was normal on laboratory examination.

The case was kept under observation for a few days and no change was noted in the man's condition. He continued to have frequency of micturition but his bowels worked normally.

AT OPERATION.—On June 28 the abdomen was opened through a left paramedian incision and a dark red, cystic tumour was found extending upwards from the pelvis between the layers of the mesentery. It filled the right side of the pelvis and displaced the bladder upwards

and forwards. It was not adherent to any other structure and could be easily pulled forward into the wound (*Fig.* 432).

After packing off the abdominal viscera the cyst was opened and 58 oz. of creamy fluid were evacuated. The fluid was of an even consistency and there were no hairs or other extraneous material. The cyst wall was about $\frac{1}{16}$ in. thick and was smooth internally, with a definite lining membrane which could be easily stripped off. There were no papillæ.

The cyst was entirely extraperitoneal and had practically no pedicle, so that complete excision was impossible. A piece of the wall was taken for microscopical examination and the tumour was then marsupialized to the anterior abdominal wall after swabbing the interior with ether.

PROGRESS.—The wound healed normally except for the drainage hole which continued to discharge a brownish fluid, and seventeen days after operation 12 c.c. of lipiodol were injected into the sinus through a rubber catheter inserted as deeply as possible. A radiograph was taken and showed a narrow irregular shadow extending from the pelvis to the anterior abdominal wall. Five days later 10 c.c. of 5 per cent formalin were injected with a view to destroying

FIG. 431.—The cyst outlined on the abdominal wall.

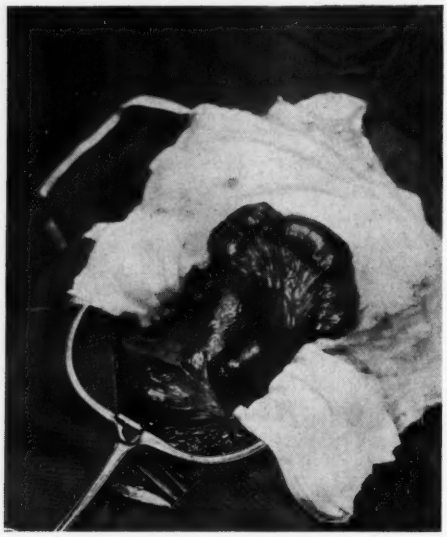


FIG. 432.—The cyst exposed at operation. Note the loop of ileum, with the tumour growing between the layers of its mesentery. Below is the bladder pushed upwards and forwards.

any remaining lining membrane; this caused a little burning pain and an increased discharge for a day or two, which gradually decreased and ceased altogether on the thirtieth day after operation, healing then being complete and a sound scar obtained.

The convalescence of this case was quite normal and from the day of operation the patient stated that he felt much more comfortable and the frequency of micturition stopped. On discharge no mass could be felt in the abdomen and the pelvic swelling could no longer be palpated per rectum.

PATHOLOGICAL REPORTS :—

1. *Fluid from Cyst.*—This contained fat globules and an occasional polymorphonuclear cell. No organisms. No mucin. No cholesterol. A cloud of albumin. Sterile on culture.

2. *Cyst Wall.*—Very active-looking granulation tissue consisting of ramifying capillaries, proliferating fibroblasts, plasma cells, histocytes, and leucocytic infiltration. No epithelial lining seen in the section.

It is emphasized that this was a case where complete removal of the cyst was impossible on account of its size and extraperitoneal situation. Marsupialization-drainage was the only alternative in spite of the statement of some authors that it is an obsolete procedure. Here a soundly healed scar was the result, with no persistent sinus formation.

PANCREATIC CYST TREATED BY IMPLANTATION INTO THE JEJUNUM

By C. L. GRANVILLE CHAPMAN
SURGEON, GRIMSBY AND DISTRICT HOSPITAL

CASE REPORT

History.—On June 17, 1936, B. W., aged 23, a labourer, was admitted to the Grimsby and District Hospital under the care of Dr. J. W. Brown. He was a strong healthy looking man and had been in the Coldstream Guards for three years. He complained of pain in the left renal region which had been there for from 6 to 8 weeks. The pain was always in the same position, there had been no pain or increased frequency on micturition, there were no enlarged glands, and no history of injury. He had had no previous illnesses.

On Admission.—A tumour was felt in the left upper quadrant, which was slightly tender on pressure and firm in consistency. It extended to the midline, downwards to the umbilicus, and upwards to the left costal margin.

Urinary System: Blood-urea 38·5 mg. per 100 c.c.

Urine: No albumin, no R.B.C.

Blood: R.B.C., 5,500,000. Hæmoglobin, 89 per cent. W.B.C., 9200. Nothing abnormal in blood-film. No casts.

Cystoscopy (June 24): Right ureter normal, left not identified. Indigo carmine excreted from right ureter in 5 minutes; no secretion on the left side.

First Operation (July 1).—Left paramedian incision. A very large cyst arising from the pancreas was found. It was coming through the thinned-out layers of the transverse mesocolon, attached firmly to the bowel on all sides, and when opened was found to be fixed firmly to the bodies of the lumbar vertebræ.

The cyst was emptied and marsupialized.

The patient made a good recovery and was discharging from the fistula 20–30 oz. of fluid per day when he left hospital.

Pathological Report.—Necrotic tissue permeated with acini of degenerated cells.

Fluid.—1 c.c. of 0·2 per cent starch was hydrolysed in 30 minutes by 0·5 c.c. fluid; 1 c.c. of 10 per cent albumin was peptonized in 3 hours by 0·5 c.c. fluid—presumptive evidence that enzymes were present. Urea in minute trace only, not more than in serum. The fluid was not contaminated with urine.

Pathological Report (February 10, 1937).—Diastase + +. Rennin, a trace.

Second Operation.—The patient was returned to hospital on October 16 with a discharge of fluid of about 20 oz. per day, but which had now become very foul. Two large stones (size of one's thumb) were removed. It was intended to implant the fistula into the jejunum, but the track was thin and the opening so wide and short that it proved impossible.

Pathological Report (October 20, 1937).—Stones from pancreatic cyst contain calcium oxalate with some organic matter.

Progress.—After this operation the foul smell disappeared.

On November 30, 1937, it was decided to try radium to attempt the closure of the sac, and a brass tube (1 mm.) containing 20 mg. of radium was dropped through the wound to the bottom of the sac and kept there for 8 hours. The radium application was repeated each week for nine weeks, but for the last seven weeks 30 mg. was used on each occasion for 10 hours. The total radiation amounted to 2580 mg. hours. There was at first some reduction in the amount of the fluid discharged, and no ill effects were observed excepting severe backache for a few days.

Third Operation.—The patient returned to hospital in a miserable condition on March 16, 1939, now discharging 20–30 oz. per day and there was a good deal of excoriation of the skin around the fistula. He was unable to work.

On April 21, 1939, under general anæsthesia, a transverse incision around the fistula was made and it was now found that there was a strong fibrous fistulous track which was dissected out with some difficulty. A rubber tube was placed in the fistula, the other end of the tube being passed through an opening in the jejunum, and the parts carefully sutured.

There was slight superficial sepsis in the abdominal wound, but it was soundly healed by May 11.

PROGRESS.—The man has now been doing full work for three months and is in excellent health. His weight before the last operation was 10 st. 12 lb.; it has since increased steadily and is now 13 st.

It is fifteen months since the operation, and X-ray photographs show the tube to be in the same position as at first, with but little evidence of any change in the rubber itself.

Commentary.—It is very rare for stones to form in a pancreatic cyst and for the cyst to become so foul smelling as this one was before the stones were removed.

With regard to radium one could say that it helped to produce fibrosis of the track and thus made it possible for a junction to be made with the jejunum. It had no other beneficial effect, but one could scarcely expect it to reduce a cavity the walls of which were held apart by such firm adherence to the lumbar vertebræ. It might have succeeded in closing a more collapsible sac.

The literature shows that a pancreatic cyst has several times been opened and drained through the stomach but with loss of ferments due to acid contents.

Kerschner[1] reports a case of implantation into the duodenum; Blinov[2] and Duncombe[3] report the performance of anastomosis between the cyst and the jejunum, the latter being a traumatic fistula.

It is interesting to consider whether anastomosis with the stomach with loss of ferments is of the same value to the economy as duodenal anastomosis, where the ferments would remain active.

REFERENCES

[1] KERSCHNER, *Beitr. z. klin. Chir.*, 1929, **147**, 28.
[2] BLINOV, N. J., *Vestnik. khir.*, 1938, **56**, 249.
[3] DUNCOMBE, C., *Mém. de l'Acad. de Chir.*, 1939, **65**, 64.

CARCINOMA OF THE THYROID GLAND GROWING INTO THE INTERNAL JUGULAR VEIN

BY J. PATERSON ROSS

FROM THE SURGICAL PROFESSORIAL UNIT, ST. BARTHOLOMEW'S HOSPITAL

GROWTH of carcinoma cells into veins is frequently observed histologically, and in renal tumours massive growth along the veins is not uncommon. Extension of the disease in this manner is rarely visible with the naked eye in thyroid carcinoma, and it must be still more rarely that surgical excision of the growth with its intravenous extension is possible. A case presenting these features may therefore be deemed worthy of record.

CASE REPORT

The patient was a school nurse, 62 years of age, who had known of a lump on the left side of her neck for eight years. The swelling had increased gradually in size, but was otherwise symptomless, and she had not noticed any loss of weight, her general health being constantly good.

Examination revealed a rounded swelling of the left lobe and isthmus of the thyroid gland of ill-defined outline, about 8 cm. in diameter, firm and elastic in its left-sided portion but extremely hard and rather tender in the part lying in front of the trachea. The swelling moved upwards on swallowing, but could not be moved upon the trachea, which was compressed antero-posteriorly though only slightly displaced to the right. There was no evidence

of involvement of any of the cervical nerves, nor was there dysphagia, though there was some degree of dyspnœa when recumbent. No enlargement of the cervical or mediastinal lymphatic glands could be made out.

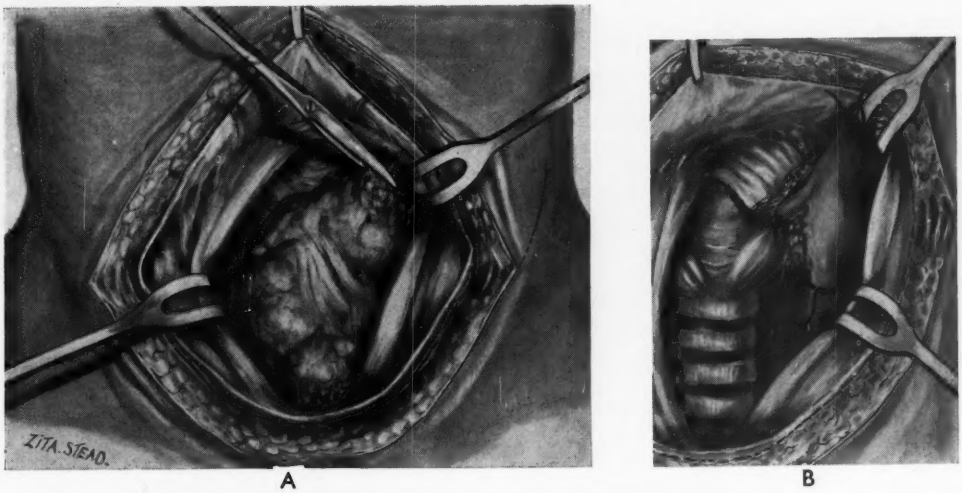


FIG. 433.—A, The freeing of the thyroid tumour; B, The swelling of the jugular vein. (*See text.*)

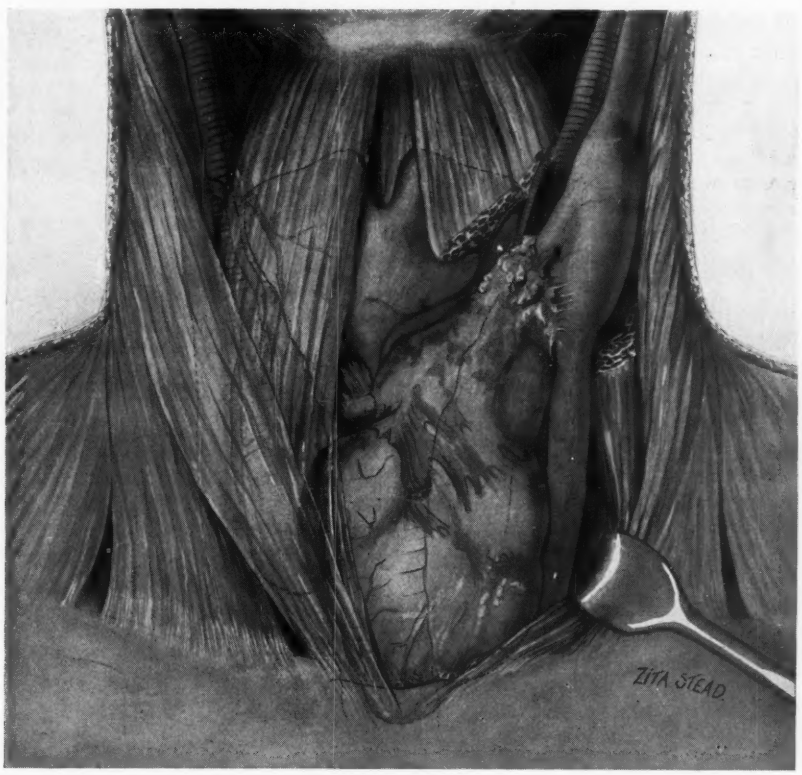


FIG. 434.—Composite picture of the condition as it existed before the infiltrated superior thyroid vein had been cut across.

Carcinoma of the thyroid gland was diagnosed, and a course of X-ray therapy was given by Dr. W. M. Levitt, eleven doses being administered between March 22, 1938, and April 4, 1938. At the end of the course the leucocyte count had dropped to 3200 cells per c.mm., and an interval was therefore allowed for recovery before operation was undertaken on April 29, 1938.

OPERATION.—The thyroid gland was exposed by the usual approach, but the infrahyoid muscles were densely adherent to the gland over the swelling—the plane of cleavage between the muscles and the capsule of the gland having been obliterated by infiltrating growth. The right lobe of the gland appeared normal, and removal of the tumour was therefore begun by a line of section running through this healthy tissue close to the isthmus of the gland. On attempting to free the left upper pole it was not possible to isolate the superior vessels clearly, and it seemed that the malignant tissue extended upwards as a thick prolongation nearly 2 cm. wide to become continuous with an outlying swelling which was at first thought to be an infected lymphatic gland. The thyroid tumour was freed by cutting through this diseased tissue at the upper pole, and the incision through the skin and muscles was then extended upwards and to the left in order to explore this second swelling (*Fig.* 433, A and B).

When fully exposed it was found to be a portion of the internal jugular vein close to the point where the superior thyroid vein entered it, and it became clear that the growth had extended along the superior thyroid vein into the lumen of the internal jugular, forming a swelling 2 cm. in diameter. The latter vein was therefore isolated and tied above and below the swelling, which was then excised together with a short length of healthy vein on each side of the tumour. *Fig.* 434 gives a composite picture of the condition as it existed before the infiltrated superior thyroid vein had been cut across.

The specimen was reconstructed and divided longitudinally to show how the carcinoma had invaded the internal jugular vein, the wall of which had been infiltrated on its lateral aspect, thus fixing the tumour within the lumen of the vessel (*Fig.* 435).

FIG. 435.—The specimen, reconstructed and divided longitudinally, showing how the carcinoma had invaded the internal jugular vein.

Histologically the tumour conformed to the malignant adenoma type of carcinoma of the thyroid gland.

PROGRESS.—The patient made a good recovery from the operation. X-ray therapy was not continued after excision of the growth; and on August 31, 1940, the patient reported that she was in excellent health and that, except for a tight feeling on the left side when she caught a cold, "the neck did not remind her of its existence".

REVIEWS AND NOTICES OF BOOKS

Surgery of Modern Warfare. Compiled by Sixty-five Contributors. Edited by HAMILTON BAILEY, F.R.C.S., Surgeon, Royal Northern Hospital, London; etc. To be issued in five separate parts. $9\frac{3}{4} \times 6\frac{7}{8}$ in. Part I: Section I, Wounds: General Considerations; Section II, Wounds: Special Considerations. Pp. 1–160, with 117 illustrations, some coloured. Part II: Section II contd.; Section III, Wounds of the Trunk; Section IV, Wounds of the Blood Vessels. Pp. 161–320, *Figs.* 118–234. Part III: Section IV contd.; Section V, Peripheral Nerve Injuries and Wounds of Tendons; Section VI, Methods of Immobilizing the Limb; Section VII, Wounds of the Hand and Foot; Section VIII, Wounds of Bones and Joints. Pp. 321–480, *Figs.* 235–502. 1940–1941. Edinburgh: E. & S. Livingstone. Each part, 12s. 6d. net.

THIS book is a credit to the publishers, editor, and contributors, not merely for the conception and accomplishment of such a work in the midst of the exigencies of modern warfare, but also in the excellence of the illustrations, lay-out, and printing.

They should be also thanked for bringing out the book at a time when it is suggestive and stimulating to those who are engaged in this type of surgery, and there are few surgeons who can be excluded from this category.

The method of publication has much to commend it, not merely as a war-time expedient, but as desirable also in times of peace. It is not everyone who wants a massive volume of surgical lore, but many would like to have a part of such a volume for future reference, or might even prefer to have the whole work permanently in separate small volumes, so that they can be carried about and read at odd times, even in bed. The parts of this book are of such a convenient size.

It would have been an advantage, however, if by exercising a little more ingenuity the publishers and editor had not ended both Parts I and II in the middle of a sentence; and Part III, though it does conclude with the end of a particular subject, nevertheless leaves off in the middle of an important section of the work. It savours very much of the time when an intense film ended suddenly, and amidst a murmur of disappointment from the audience one read the caption that further reels of this enthralling drama would be shown on some subsequent occasion. The value of the 'parts' would have been much enhanced if each had been more or less complete in itself, and if a suitable reading case had been supplied with the first part, which could have been transferred to the others as required.

It is hoped that this idea in publication will be further developed in the future. Separate parts if sufficiently small, as in this book, would not need a separate index. An index could be purchased for the whole work if the reader considered that the book as a whole was worthy of binding and a permanent place in his library.

To control and correlate the views and style of sixty-five contributors such as has been done in this book must have been a task worthy of such a compère as Mr. Hamilton Bailey. It is not to be wondered at that read critically there are contradictions and differences of opinion expressed, or that there is an inevitable overlapping in some of the sections. In such a book, and with such a subject, this is an advantage rather than otherwise. The fact that so few dogmatic views are sustained indicates that the surgery of modern warfare is a subject for the discernment and judgement which comes with experience, and is not to be undertaken lightheartedly or as an heroic interlude. It is a great advantage for the thoughtful clinical student in that having to deal with a subject which can never be standardized, he realizes from his teaching that no dogmatic opinion can be final. No matter how many schools of thought may be presented to him, he finally has to evolve his own.

The surgery of modern warfare has been affected by the change in the missiles now used, especially the aerial bomb. Wars have become so prevalent in the present century that some general principles in the treatment of the resulting injuries are gradually emerging. These principles, such as the treatment of shock and the prevention of the contaminated wound becoming a source of infection, are stressed throughout the whole volume. The early use of

chemotherapy is rightly insisted upon, and the lack of any really dependable antiseptic is everywhere recognized; this, however, does not detract in any way from the epoch-making character of 'Listerism'.

The sections of the book follow in sequence, illustrating the method of reception, examination, and treatment of the injured. All methods of treatment whether by transfusion, operation, manipulation, or splinting are so explained that careful study by even the uninitiated would teach them not to interfere with the natural methods of healing and prepare them for the recognition and treatment of complications.

The section on tetanus in *Part* I is the best article on the subject the reviewer has ever read, and is a model of terseness with lucidity.

The section on anæsthetics in *Part* I is disappointing. If only six pages could be given to such a subject then it would have been better left out. It is difficult to understand why barbiturates should not be given in face wounds, and also, with modern intratracheal methods of anæsthesia, why a tracheotomy set should always be kept sterilized near the anæsthetist.

The article on maggot therapy is very welcome, and will it is hoped stimulate many surgeons to investigate the possibilities of this method. Any surgeon who had experience of maggot infested wounds during the last war could not fail to be impressed with the general good health of the patient and the healthy appearance of the wound when the maggots were removed.

The articles on thoracic and intestinal wounds are as excellent as they are authoritative and could not be improved upon. The evolution of abdominal wound treatment is a good introduction to the subject, which ends on the note of 'look and see' rather than 'wait and see'.

The principles of adequate drainage and rest are stressed for abdominal wounds, as for those of the extremities.

The article on vascular injuries is very lucid and should help the surgeon in understanding and solving many of the problems presented not only by these injuries, but also the results of vascular disease which are becoming so common. The operations for exposure of the vessels are fully described and beautifully illustrated.

The section on injuries to the hands and feet, while terse and useful, is also exhaustive and indicates long experience in dealing with these conditions.

The methods of splinting the extremities are described and illustrated with meticulous care; the surgeon would do well to study them all before committing himself wholly to one method.

The Art of Surgery. A Text-book for Students and Practitioners. By H. S. SOUTTAR, D.M., M.Ch. (Oxon.), F.R.C.S.(Eng.), Surgeon, London Hospital; Member of Court of Examiners, Royal College of Surgeons of England. Fourth edition. In two volumes. $7\frac{5}{8} \times 5\frac{3}{8}$ in. Pp. 779 + xvi, with numerous illustrations. 1940. London: William Heinemann (Medical Books) Ltd. 25s. net complete.

WE have already had the pleasure of writing a favourable review of an earlier edition of this student's text-book, and we have no hesitation in congratulating the author and publisher on its new format. Whereas former editions were in one rather large and unwieldy volume, the present is in a much more convenient form, in two volumes, which can be more easily carried about by the clinical student. The original thumb-nail sketches are retained and a number of fresh line drawings added. The coloured illustrations have been dispensed with. The text of the book is retained without much alteration, but with a good many additions. In its present form the book will make a great appeal to students because of its clear and lucid style. There is a good summary of modern fracture treatment, and the fact that the closed plaster method of treating open fractures is summarized in twelve lines, gives some idea of the author's capacity for concise statements.

A good many of the statements are not only open to criticism but we venture to suggest that they do not represent the generally accepted teaching such as the student would surely find in the wards of a modern hospital. For instance we are told that the treatment of an intracapsular fracture of the neck of the femur is by a walking calliper splint; the Smith-Petersen pin is not mentioned. We are told that for a tuberculous hip in an adult, excision of the head of the bone is often required and that it quickly gives rise to firm bony union. In the treatment of cleft palate Langenbeck's operation is described and figured as the standard, and the modern operations are not adequately dealt with. We can find no mention of the principles or methods of sympathectomy, not even for Hirschsprung's disease. The

use of fascial strips in hernia operations is criticized as involving " extensive operations " and there is no mention of the fasciotome.

These points of course only represent a small part of the whole, but we feel that they ought to be corrected in order to bring the book into line with modern teaching.

Fractures. By GEORGE PERKINS, *M.C.*, M.Ch.(Oxon.), F.R.C.S., Assistant Orthopædic Surgeon to St. Thomas's Hospital. $8\frac{1}{2} \times 5\frac{3}{8}$ in. Pp. 384 + xi, with 401 illustrations. 1940. London: Humphrey Milford (Oxford University Press). 20s. net.

ONE is inclined to take up a new book on fractures nowadays with a feeling of doubt as to whether there can be any justification for new writing on this old subject. But one is bound to admit that the author has fully justified his work, because he has dealt with the whole subject in a new and original style which is quite his own. The most remarkable feature about the method in which he presents his subject is its concise dogmatism. Not a word is wasted in discussing theories or opinions. The reader is merely told of the facts and of how he should act in relation to them. In the first place we note as characteristic of this economy of words that there is neither Preface nor Introduction of any kind, and the reader is left to form his own conclusions as to why the book was written and what it is all about. The first part, which deals with general principles such as reduction, fixation, and protection, is very clear and informative and it reads rather like the instruction of a teacher to students. He divides the stages of treatment into four periods: the first is that of reduction, the second is that of fixation until union occurs, the third is that of protection until consolidation has been achieved, and the fourth is that of recovery of function after bone repair is complete.

The main bulk of the book consists in a description of individual fractures, together with directions as to their treatment. All the illustrations are of a diagrammatic character, and they conform very well to the dogmatic character of the book. Operative methods find a very small place, being almost confined to those of transfixion for skeletal traction and the insertion of a Smith-Petersen pin. On the whole the methods of treatment advocated are those that are generally accepted, but of course it would be possible to pick out various statements as being open to a difference of opinion, such for example as the suggestion that the only treatment for recurrent dislocation of the patella should be by removal of the bone. But no purpose would be served by pointing out these controversial subjects. We may be sure that the book will receive a wide popularity, especially among students, who will find in it clear teaching and simple illustrations.

Fractures and other Bone and Joint Injuries. By R. WATSON-JONES, B.Sc., M.Ch. Orth., F.R.C.S., Hon. Orthopædic Surgeon, Royal Liverpool United Hospital (Royal Infirmary); Visiting Surgeon, Robert Jones and Agnes Hunt Orthopædic Hospital. Second edition. $9\frac{3}{4} \times 7$ in. Pp. 724 + xii, with 1040 illustrations, some coloured. 1941. Edinburgh: E. & S. Livingstone. 50s. net.

THIS book made a very timely appearance a year ago and we are more than justified in the high praise which we gave to it by the fact that a new edition has been called for within such a short time. As we predicted, the book is regarded as the leading one on the subject in the English language. Naturally in the short space of time, very little revision has been necessary. The chapter on open and infected fractures has been re-written and recent developments in chemotherapy and blood and plasma transfusion have been included. We cannot refrain from again drawing attention to the excellence of the illustrations. They have been so well chosen and so beautifully executed as to make them and their legends well worth the price paid for the book.

Bone Graft Surgery in Disease, Injury and Deformity. By FRED H. ALBEE, M.D., LL.D., Sc.D., F.A.C.S., F.I.C.S., President International College of Surgeons, etc. Assisted by ALEXANDER KUSHNER, M.D., B.Sc. $9\frac{3}{8} \times 6\frac{1}{2}$ in. Pp. 403 + xx, with Frontispiece and 297 illustrations. 1940. New York and London: D. Appleton Century Co. 35s. net.

THIS is a most valuable and notable book, because it is from the pen of the man who really invented modern bone-graft surgery, about which he first wrote twenty-five years ago.

It is, perhaps, remarkable not so much for advances and innovations which have taken

place during that time as for the essential sameness of the principles enunciated by Albee a quarter of a century ago. Dr. Winnett Orr in writing the foreward pays a well-merited tribute to the soundmess of the author's scientific work, and to the great advances made possible by his technical methods. These have greatly widened the field of bone-graft surgery.

He begins by discussing the general principles and draws attention to the lessons to be learned from the grafting of plants, in which we learn the importance of accurate fitting, close coaptation, and firm fixation. In the chapter on the armamentarium of the orthopædic surgeon he describes the latest modification of the saw, which he describes as a bone mill and a lathe for the turning of pegs and screws. He also gives a full description of the special orthopædic table which bears his name, and which enables all the necessary adjustments of the limb to be made and permits of X-ray examination. He then describes all the various operations, most of which he has devised himself, for the stabilization of the spine, the fixation of the hip-joint, the mending of ununited fractures, the replacement of bone lost by accident or disease, plastic bone-graft surgery, the arthrodesis of joints, and the limitation of joint movements by bone-graft operations.

The elaboration of his methods represents the introduction of exact joinery and engineering to surgical practice. The way in which these methods are described and illustrated gives one a very clear idea of each procedure, but it leaves on the mind the feeling that such methods can only be carried out by those with special training and aptitude. If the perfection of his technical methods excites our admiration and envy, many of his general statements about the indication for these operations are open to criticism. In this matter his attitude to bone-grafting of the spine for tuberculosis is the most prominent. He says, " Operative treatment is a *sine qua non* to be given precedence over other therapeutic measures " ; again, " I stand emphatically for early operation " ; and again, " Operate on any patient at any age provided the surgical risk is good ; indication for operation is increased when an abscess or sinus is present ". We venture to think these extreme views are not borne out by general surgical experience.

His treatment of fracture of the neck of the femur is a good example of the technical elaboration of his methods, but the fashioning of a bone-peg from the crest of the tibia is a much more difficult process than that of using a piece of the fibula for the purpose of the graft. His complicated and ingenious methods for treating a fracture of the patella, the fixation of a scoliotic spine, the formation of a new jaw from the crest of the ilium, all evoke our admiration for the author's ingenuity, but they are hardly likely to find many imitators, because of their difficulty and complexity.

The illustrations, most of which have appeared before in various American publications, are models of clearness and artistic merit.

Injuries of the Jaws and Face. With Special Reference to War Casualties. By W. WARWICK JAMES, O.B.E., F.R.C.S., L.D.S.(Eng.), Member of the Army Advisory Standing Committee on Maxillo-facial Injuries ; Consulting Dental Surgeon to the Middlesex Hospital and the Hospital for Sick Children, Great Ormond Street ; Late Dental Surgeon and Lecturer in Operative Dental Surgery, Royal Dental Hospital of London ; etc. ; and B. W. FICKLING, F.R.C.S., L.D.S.(Eng.), Assistant Dental Surgeon to St. George's Hospital and to the Royal Dental Hospital of London. $9\frac{5}{8} + 5\frac{7}{8}$. Pp. 199 + xii, with 194 illustrations. 1940. London : John Bale & Staples Ltd. 15s. net.

THIS book, written by two well-known authorities on maxillo-facial injuries, supplies a real want and fills a gap in British surgical literature.

In the preface the authors apologize to the reader because the book, they say, has been compiled in a hurry, and also because the material only consists of the records of 475 cases, very few of them complete, which were treated at the Third London General Head-quarters during the years 1916–21. As a matter of fact, far from asking for an apology, the reader should express thankfulness that in their so-called hurry the authors have confined themselves to the essentials and important parts which will appeal to all called upon to treat this type of injury.

The methods they describe are those which they themselves have found useful, and throughout the whole book there is an absence of unnecessary ' padding '.

First aid must be directed towards maintaining a clear airway ; even tracheotomy may be necessary.

In the absence of an expert, anæsthesia presents particular difficulties in these cases. The endotracheal tube may introduce sepsis, though this can be obviated if the tube only reaches the nasopharynx. The authors give no opinion as to the use of intravenous evipan or sodium pentothal, but rely on gas and oxygen or ether.

The authors are very definite in retaining teeth rather than extracting them during the early phases of treatment, and bring forward much convincing evidence in support of their view. It should be a rule that extraction must be delayed until the mouth is clean.

Similarly with the soft tissues; while insisting on an adequate excision of the wound, yet the vascular supply is so good that it is better to err on the side of retention of any doubtful tissue.

The problem of 'foul mouth' and its accompanying serious complications of secondary hæmorrhage and bronchopneumonia can best be treated by early operation and *adequate fixation* of the fracture.

Bronchopneumonia, far from being a contra-indication to operation, should decide the surgeon to carry out fixation of the fragments immediately. The patient can then cough in comfort. It is in this sort of case that it is suggested to the authors that intravenous anæsthesia might be invaluable.

The authors point out how frequently there are multiple fractures of the mandible. The most important clinical sign is disturbance of the relation of the teeth. These must be examined for changes in occlusion, alinement, elevation, or depression.

The great difficulty in dealing with fractures of the mandible is the problem of the 'posterior fragment'. If the patient is edentulous then it is better to leave the posterior fragment alone, and if necessary do a bone-graft much later. The question of 'splinting' in fractures of the mandible presents many special difficulties. In the authors' opinion, which will be endorsed by all surgeon dentists, the ideal splint is that of 'occlusion and interdental wiring'. The methods of wiring are fully described in detail and excellently illustrated.

Acute infections such as gas gangrene and tetanus are rare in facial injuries; the early facial paralysis that precedes the trismus in cephalotetanus is duly stressed. Acute cellulitis, erysipelas, or suppurative lymphatic gland involvement is also rare. These latter can be anticipated or treated by chemotherapy, but the presence of pus, sloughs, and necrotic tissue which is so common in mouth wounds limits their effective use. Moreover the severity of the injury is such that it may be difficult to assess the clinical importance of symptoms whether due to complication or drug therapy. They are probably of more use in prophylaxis as a pre-operative step, but then it must be remembered that intravenous sodium pentothal is dangerous; and up to the present there is no drug which acts on the *Streptococcus viridans*.

The late complications of face injuries are chronic persistent infection, mal-union, delayed union, and non-union. The importance of surgical principles in prevention of these complications is rightly insisted upon, viz. :—

Early and efficient treatment, especially in securing adequate immobilization of the fragments, and this should be maintained without interruption.

The author's opinion is that proper fixation is more important than cleanliness in mouth wounds, and by securing this within a few hours of the injury secondary shock can be prevented.

Later in the treatment necrosed fragments should not be removed until completely separated, and foreign bodies should only be removed if this can be done without opening up uninfected tissue.

The nursing of these cases presents very special difficulties which only a well-trained staff of nurses can overcome. The co-operation of the patient should be encouraged in the regular washing out of the oral cavity.

There can be no doubt in the mind of any surgeon after reading this book of the wisdom of collecting these cases in special 'maxillo-facial' centres. In probably no branch of surgery is it more true to say that 'successful surgery is early surgery'.

The authors and publishers are to be congratulated on issuing this book at such an important time.

It is dedicated "to the true authors of this book: courageous, uncomplaining men, tempered by fear and disregard of self, whose wounds so terribly denied the full expression of their greater being".

Diseases of the Urethra and Penis. By E. D'ARCY MCCREA, M.D., M.CH. (Dub.), F.R.C.S.I., F.R.C.S. (Eng.), late Hon. Surgeon at Salford Royal Hospital, Manchester. $8\frac{7}{8} \times 6$ in. Pp. 306 + viii, with 181 illustrations, some in colour. 1940. Bristol: John Wright & Sons Ltd. 21s. net.

THIS book might more accurately be called "Diseases of the Penis and the Male Urethra" because conditions affecting the female urethra are not discussed. Perhaps these will be dealt with in a subsequent edition. The book covers the subject fully, and particularly useful are the references to literature given at the end of each chapter.

The opening chapter describes the development and anatomy of the penis and urethra in considerable detail; it omits, however, to mention the nerve-supply to the skin of the penis; in *Fig.* 9 the position of the striated sphincter does not agree with the text, nor is it clear from the legend what the layer of muscle so designated really is. In Chapter V, which deals with injuries of the urethra, few will agree that it is reasonable to wait whilst an intravenous pyelogram is undertaken if there is any reason to suspect a rupture of the bladder.

Two chapters are devoted to urethritis. No doubt that is inevitable, but so much has been written on this subject that it may be thought that a discussion of gonorrhœa in its acute and chronic stages, but not its complications, might have been omitted altogether. No mention is made of the formation of prostatic calculi as a complication of chronic prostatitis. Neither in the chapter on Congenital Malformations, nor in that on Stricture, is there any mention of the condition of pinhole meatus, so often seen in boy infants, nor the simple operation and careful after-treatment by which it can be so successfully cured.

Many rare conditions, such as tumours of the urethra and of the penis, are fully described, with a valuable bibliography. The book is nicely written and well illustrated and will be useful both to surgeons and venereologists.

Treatment of Cancer and Allied Diseases. By 147 international authors. Edited by GEORGE T. PACK, B.Sc., M.D., F.A.C.S., Attending Surgeon, Memorial Hospital, New York; Assistant Professor of Clinical Surgery, The School of Medicine, Yale University, New Haven, and Cornell University Medical College, New York; and EDWARD M. LIVINGSTON, B.Sc., M.D., Associate Visiting Surgeon, Bellevue Hospital; Assistant Clinical Professor of Surgery, New York University College of Medicine; Assistant Attending Surgeon, Memorial Hospital, New York. In three volumes. 10 × 7 in. Vol. I, Pp. 1–920 + xc; Vol II, Pp. 921–1812 + liv; Vol. III, Pp. 1813–2598 + cxi (includes complete index). 1500 illustrations, 1940. New York and London: Paul B. Hoeber, Inc. The set, $36.00.

IT is very difficult to give an adequate representation of a work such as this in the space at our disposal. It is a veritable encyclopædia, and as such we can only give a bare outline of its general arrangement.

It is written by a group of young and enthusiastic American surgeons, who have evidently closely collaborated with one another and with the editors. There are a few names of well-known American surgeons of senior rank such as Crile, Judd, Ewing, and Charles Mayo, but otherwise most of the writers are men in charge of surgical or radiological departments whose names are not so well known in this country. There are three English surgeons among the writers, Lenthal Cheatle (radical mastectomy), Geoffrey Keynes (the radium treatment of breast cancer), and Sampson Handley (elephantiasis of the arm after mastectomy). There are also articles by two Continental surgeons—Polya, of Budapest, and Zuppinger, of Zurich.

The declared object of the work as explained in the Preface is to provide a reservoir of information to which reference can be made by those interested in any particular problem of cancer treatment. Problems of theoretical importance have been rigidly excluded so as to devote concentrated attention upon the practical questions of diagnosis and treatment. The editors have allowed themselves freedom to criticize and comment upon the various articles, and they write special prefaces to the articles on the rectum, stomach, and breast with the special view of correlating researches on the significence of end-results. The book is intended especially for the general practitioner, because it is through his hands that the cancer patient first comes to the surgeon and the clinic. The actual curability of cancer varies enormously according to its site; the lip cancers having a curability of about 80 per cent, that of the œsophagus being practically nil. But though many a patient may be incurable, none is untreatable, and it is the business of all who have these patients under their care to know what can be done to prolong life and to alleviate suffering.

The first volume opens with a section on general principles of treatment, which includes chapters on microscopical grading, various methods of biopsy, and radiosensitivity. Nearly 300 pages are devoted to the use of radium and other methods of radiation. The remainder of the volume is occupied by sections on the mouth and pharynx, larynx, neck, thyroid, breast, and chest. There is a very full description of methods of treatment of glandular involvement in the neck.

The second volume deals with malignant disease of the œsophagus, stomach, intestines, colon, rectum, and female genitals. The section on the stomach is perhaps the most detailed of any part of the book. It opens with a chapter on gastroscopy and then discusses the pre- and post-operative treatment of stomach cases. The most remarkable feature of this section, however, is that dealing with end-results. This occupies more than 150 pages, and the charts and diagrams give a bewildering amount of information, the mere summary of which occupies sixty-five paragraphs. The section on the rectum describes and illustrates many methods, including the one- and two-stage abdomino-perineal operation and also the methods associated with the names of Rankin, Babcock, and Coffey.

The third volume deals with the urinary system, male genitals, skin, eye and orbit, nervous system, bones and synovial membranes, lymphoid tissues, and various miscellaneous subjects. In discussing cancer of the bladder a full account is given both of cystoscopic and also of suprapubic approach, by which both surgical and radiation methods can be employed. The chapter on the prostate is by Hugh Young, who describes in some detail the method of perineal approach. The treatment of teratoma testis is only by radiation methods as it is considered that any radical operation is useless.

In the section on the skin some space is devoted to a consideration of precancerous lesions. The chapters devoted to plastic repair after the removal of new growths of the skin is not detailed enough to be very helpful. A consideration of the nervous system is very full and well illustrated, beginning with a very clear article on brain surgery by Adson. There is also a very good chapter on the relief of pain by various types of chordotomy.

In the section on malignant disease of bones radiation therapy is given a prominent place, and other subjects, such as the management of pathological fracture secondary to metastatic tumours of the bone, and the treatment of bone sarcoma by Coley's mixed toxins, are given due prominence. The last section dealing with miscellaneous subjects includes a discussion of fever therapy, treatment by colloidal lead, and euthanasia.

The illustrations throughout the book are beautifully drawn and reproduced, and the whole work does the greatest credit to the editors, authors, and publisher.

Common Mistakes of Surgery in India and How to Avoid These. By Lieut.-Col. A. N. PALIT, O.B.E., F.R.C.S. Edin., M.R.C.O.G., I.M.S. (Rtd.), Senior Surgeon, Chittaranjan Seva Sadan Hospital, Calcutta. $7\frac{5}{8} \times 5\frac{3}{8}$ in. Pp. 382 + xix, illustrated. 1940. Calcutta: The Book Co. Ltd. 8s. 6d. net.

THIS is an interesting book. Col. Palit has set himself the difficult task of trying to make it possible for his juniors to take off from where he has now arrived after years of skilful work. The book does not detail long lists of common surgical mistakes. Rather does it set forth practical rules for the guidance of medical officers undertaking surgery under the conditions commonly obtaining in India. It is difficult in a book of this kind to avoid entirely those telling stories in which all the mistakes have been committed by the other doctor; but much could be forgiven an author who can write: "Most of us in India are mere camp followers of the great, and it ill behoves us to talk about ourselves."

Taking the book as a whole there is little doubt that it will achieve the object for which it was written. It will help the doctor in charge of a small hospital and the young surgeon, and perusal of its pages will prove not altogether unprofitable to the more experienced senior surgeons. There is much wisdom condensed in this little book. Based as it is on the author's own wide experience of surgery in India, it also bears evidence of careful selection of methods culled from judicious reading and personal contact with many of the master surgeons of Europe. There are some shrewd comments in this book on certain methods in vogue at large centres of surgical teaching. Col. Palit's advice to the young surgeon is worth quoting: "The young surgeon should avoid unnecessary and uncalled-for interference, and he should go up the rungs of the ladder slowly. He should not try to be a pioneer, as only an expert can do that."

There are some errors which might have been avoided by more careful reading of the proofs, and there is no index. One hopes that the following sentence is an exaggeration of the conditions in India: "However, used on an open mask ether is fool-proof, only be careful there is no open fire anywhere near, and *do not let the surgeon smoke* (italics are the reviewer's).

BOOK NOTICES

[The Editorial Committee acknowledge with thanks the receipt of the following volumes. A selection will be made from these for review, precedence being given to new books and to those having the greatest interest for our readers.]

A Short Practice of Surgery. By HAMILTON BAILEY, F.R.C.S. (Eng.), Surgeon, Royal Northern Hospital, London; Surgeon and Urologist, Essex County Council, etc.; and R. J. MCNEILL LOVE, M.S. (Lond.), F.R.C.S. (Eng.), Surgeon, Royal Northern and Metropolitan Hospitals, etc. Fifth edition. $8\frac{1}{2} \times 5\frac{1}{2}$ in. Pp. 1015 + viii, with 880 illustrations, of which 116 are coloured. 1941. London: H. K. Lewis & Co. Ltd. 30s. net.

Illustrations of Regional Anatomy. By E. B. JAMIESON, M.D., Senior Demonstrator and Lecturer, Anatomy Department, University, Edinburgh. Third edition. $8 \times 6\frac{1}{8}$ in. Section I, Central Nervous System (49 plates), 7s. 6d. net; Section II, Head and Neck, (64 plates), 15s. net; Section III, Abdomen (41 plates), 6s. net; Section IV, Pelvis (34 plates), 4s. net; Section V, Thorax (31 plates), 4s. net. 1941. Edinburgh; E. & S. Livingstone.

A Text-book of Surgical Pathology. By C. F. W. ILLINGWORTH, M.D., Ch.M., F.R.C.S. (Edin.), Regius Professor of Surgery, University of Glasgow; and B. M. DICK, M.B., F.R.C.S. (Edin.), Lecturer in Clinical Surgery, University of Edinburgh; Assistant Surgeon, Edinburgh Western Hospital. Fourth edition. $9\frac{3}{4} \times 6\frac{1}{8}$ in. Pp. 728 + viii, with 300 illustrations. 1941. London: J. & A. Churchill Ltd. 38s. net.

Abdominal Operations. By RODNEY MAINGOT, F.R.C.S., Senior Surgeon to the Southend General Hospital, and to the Royal Waterloo Hospital, London; etc. $9\frac{5}{8} \times 6\frac{1}{2}$. In two volumes. Pp. 1385 + xvi, with 298 illustrations. 1941. New York and London: D. Appleton-Century Co. £5 net.

Surgery of Modern Warfare. Compiled by Sixty-five Contributors. Edited by HAMILTON BAILEY, F.R.C.S. (Eng.), Surgeon, Royal Northern Hospital, London; etc. To be issued in five separate parts. $9\frac{3}{4} \times 6\frac{7}{8}$ in. Part IV: Section VIII contd.; Section IX, Wounds of the Face and Neck, including those of the Special Senses. Pp. 481-640. *Figs.* 503-683. 1941. Edinburgh: E. & S. Livingstone. Each part, 12s. 6d. net.

A Complete Outline of Fractures, including Fractures of the Skull. By J. GRANT BONNIN, M.B., B.S. (Melbourne), F.R.C.S. (England), M.R.C.O. G., First Assistant to the Injury Clinic, West London Hospital; Orthopædic Registrar, St. John's Hospital, Lewisham; Acting Registrar, Royal National Orthopædic Hospital. $9\frac{1}{8} \times 6$ in. Pp. 507 + xii, with 570 illustrations. 1941. London: William Heinemann (Medical Books) Ltd. 25s. net.

INDEX TO VOLUME XXVIII

PAGE

ABDOMINAL testis, seminoma in, with glioma of the brain - - 357
Abducens nerve paralysis in naso-pharyngeal carcinoma - - 523
Abductor paralysis in nasopharyngeal carcinoma - - - - - 525
Aberrant carotid gland, tumour of - 164
Abscess, fixation, in septicæmia - - 130
— formation in sacro-iliac tuberculosis 194
Absorption collapse of lung - - 407
Acetylene as an anæsthetic - - 619
Acridine compounds as antiseptics - 475
— — — in brain wounds - - - 482
Acriflavine as an antiseptic - - 474
— — in brain wounds - - - 482
ADAMS, A. WILFRID : Testicular tumours 119
Age incidence of acute hæmatogenous osteomyelitis - - - - - 261
— — carotid tumours - - - 163
— — fractures of head and neck of radius 108
— — inguinal hernia - - - 392
— — nasopharyngeal carcinoma - 519
— — sacro-iliac tuberculosis - - 194
— — sarcoma of muscles - - - 3
— — secondary infection in tuberculous sinuses - - - - - - 415
— — Volkmann's ischæmic contracture 241
— in prognosis of sacro-iliac tuberculosis 205
— relation to neural damage after carotid ligation - - - - - 66
— — treatment of tuberculous disease of ankle and tarsus - - 79
Alkali poisoning in gastric ulcer, case report - - - - - - 504
Amniotic adhesions causing fœtal malformations - - 173 et seq.
Amputation in tuberculous disease of ankle and tarsus - - - 81
Anæmic infarction of bowel, pathological anatomy - - - 350
Anæsthesia and analgesia - - - 615
— — local analgesia - - - - 623
— — premedication - - - - 615
— — preparation of the patient - 615
— — spinal analgesia - - - 625
— for bronchoscopy - - - - 404
— endotracheal - - - - - 621
— inhalational - - - - - 617
— intravenous - - - - - 622
— mesenteric vascular occlusion - 352
— non-narcotic gases used in - - 620
— for repair of inguinal hernia - - 393
Analgesia (*see* Anæsthesia and Analgesia)
Anastomosis in resection of growths of lower pelvic colon, new technique 320

PAGE

Anencephaly - - - - - - 185
Aneurysm, arteriovenous - - - 582
— of cœliac artery, case report - - 502
— extrathoracic, disappearance of, case report - - - - - - 144
— saccular intracranial, carotid ligation in (*see* Carotid Ligation)
Angiography in infraclinoid aneurysm 55
Angioma of gracilis muscle - 10, 11
Ankle and tarsus, tuberculous disease of, end-results and treatment - 71
— — — — — — — adults - - - 77
— — — — — — — children - - 72
Antiseptics in brain wounds - - 472
— — — conclusions - - - - 497
— — — discussion - - - - 494
— — — experimental methods - - 476
— — — introduction - - - 472
— — — summary of experiments - 478
— — — survey of surgical antiseptics 474
— — — synopsis - - - - - 472
Aponeurotomy in Volkmann's ischæmic contracture - - - - - 256
Arm (*see* Upper Limb)
Arterial embolism and injury, Volkmann's contracture and - - - 249
— mesenteric occlusion - - - 350
Arteriectomy in prevention of Volkmann's contracture - - - - - 257
Arteriovenous aneurysm - - - 582
Artery, cœliac, aneurysm of, case report - - - - - - 502
Arthritis, suppurative, in acute hæmatogenous osteomyelitis - - 268
Arthrodesis in tuberculous disease of ankle and tarsus - - - 80
Asepsis in secondary Thiersch grafting 601
Aschheim-Zondek test in testicular tumours - - - - - - 358
Ascorbic acid (*see* Vitamin C)
Astragalus (*see also* Ankle)
— dislocations and fracture-dislocations of (*see* Dislocations)
— traumatic expulsion of - - - 611
Asymptomatic scurvy - - - - 438
Atropine premedication in anæsthesia - 615
Avertin as basal narcotic in anæsthesia 616
Azochloramid as antiseptic - - - 475
— — in brain wounds - - 488, 496

BACTERIÆMIA in acute osteomyelitis, treatment - - - - - 272
BAILEY, HAMILTON : The treatment of tumours of the parotid gland - 337

PAGE

BAINES, G. H.: Supernumerary and ectopic ureters - - - - 314
BAKER-BATES, E. T., and MCGIBBON, JOHN E. G.: A bronchoscopic clinic - - - - - - 404
Barbiturates as basal narcotics in anæsthesia - - - - - - 616
— intravenous anæsthetics - - - 622
BARLOW, DONALD: 'Simple' ulcers of the cæcum, colon, and rectum - 575
BARLOW, T., and MOTTERSHEAD, S.: Anatomical note on a case of persistent intussusception in an adult - - - - - - 429
Basal narcosis in anæsthesia - - 616
Bassini's operation in inguinal hernia 385, 397
BENNETT-JONES, M. J., and HARRISON, C. V.: Seminoma in an abdominal testis with a glioma of the brain - - - - - - 357
Bile-duct, common, obstruction of, by duodenal diverticula - - - 371
— — removal of *F. hepatica* from (*see F. hepatica*)
Biliary passages, emphysema of - - 325
Blair's incision for exposure of parotid gland - - - - - - 339
Blood-ascorbic acid estimations in animals 447, 450
Blood-counts in diagnosis of septicæmia 128
Blood-cultures in diagnosis of septicæmia 127
Blood-pressure, low, carotid ligation and 67
Blood-supply of intestines - - 347, 348
— to talus - - - - - - 92
Blood-volume in rupture of liver - 545
Bone changes in spinal tumours - 561
Bone-pegging in fracture-dislocations of ankle - - - - - - 99
BONNIN, J. GRANT: Dislocations and fracture-dislocations of the talus 88
Bougies in self-dilatation of non-malignant stricture of œsophagus 275
Brain, glioma of, in case of seminoma of abdominal testis - - - - 357
— wounds, antiseptics in (*see* Antiseptics)
Bromethol as basal narcotic in anæsthesia 616
Bronchial obstruction, incomplete and complete - - - - - - 407
— tumour, removal of portion for histological examination by bronchoscope - - - - - - 406
Bronchoscopic clinic - - - - - 404
— — anæsthesia - - - - - 404
— — bronchoscopic findings - - 406
— — — procedures - - - - 405
— — — therapy - - - - 413
— — instruments - - - - - 405
— — personnel - - - - - 404
— — signs and symptoms referred to bronchoscopy - - - 408
Bronchus, primary chondroma of - 571
Buccal grooves and creases, congenital 173, 181

PAGE

BURROWS, H. JACKSON: Spontaneous fracture of the apparently normal fibula in its lowest third - - 82
BUTLER, E. C. B.: The treatment, complications, and late results of acute hæmatogenous osteomyelitis - - - - - - - - 261

CÆCUM, colon, and rectum, 'simple' ulcers of - - - - - - - 575
Calculus extruded from duodenal diverticulum causing obstruction, case report - - - - - - 329
Calf muscles of infant, sarcoma of - 3
Canal, Hunter's, myxosarcoma arising in connective tissue of - - 10
Cancer, carotid ligation and - - 67
Carbon dioxide absorber in closed-circuit N_2O administration - 619
— — in inhalation anæsthesia - - 620
— tetrachloride in *F. hepatica* infection in man - - - - - - 382
Carcinoma of double kidney with ectopia of one ureter - - - - 314
— duodenal, associated with diverticula 377
— nasopharynx (*see* Nasopharyngeal Carcinoma)
— thyroid growing into internal jugular vein, case report - - - 634
Carotid ligation in conditions other than intracranial aneurysms - - 66
— — saccular intracranial aneurysms - 50
— — — — — analysis of material - 52
— — — — — historical - - - 50
— — — — — pathology of cerebral lesion - - - 60
— — — — — summary - - - 68
— — — — — theories of post-operative neural damage - 62
— sinus in relation to neural damage after carotid ligation - - 65
— tumours - - - - - - 163
— — conclusions - - - - - 172
— — reports of personal cases - - 165
— — operative surgery - - - 169
Cartilaginous tumour of ulnar shaft - 432
Cast, Stent, in reparative surgery of upper limb - - - - - 592
Catgut ligatures in wounds, disappearance of, experimental - - 445
Cellular proliferation in wound healing 436
— — — — experimental - - - 441
Cervical gland enlargement in nasopharyngeal carcinoma - 521, 529
— sympathetic trunk affected in nasopharyngeal carcinoma - - 523
CHAPMAN, C. L. GRANVILLE: Pancreatic cyst treated by implantation into the jejunum, case report - - 633
Cheek in nasopharyngeal carcinoma 523, 531
Chemotherapy in acute hæmatogenous osteomyelitis - - - - - 272
Chest complications, recurrence of inguinal hernia and - - - 399

PAGE
Chest, dumb-bell ganglioneuroma of - 608
Chloramine-T as antiseptic - - 475
Chloroform anæsthesia - - - 620
Cholangitis from duodenal diverticulitis 377
Cholesterosis of gall-bladder - - 462
Chondroma of bronchus - - - 571
Chorionepithelioma, secondary, in gastrocnemius - - - - 10, 11
— testis - - - - - - 120
Circle of Willis, neural damage after carotid ligation and - - - 65
CLARKE, RUSCOE: A case of liver 'sequestrum' complicating subcutaneous rupture of liver - 544
Cleft of mandible and lip, congenital median - - - - - 182
— oro-temporal, congenital - - 183
Clostridium welchii septicæmia (*see* Septicæmia)
Club-foot, congenital - - - - 191
Coal-tar derivatives as antiseptics - 475
— — — in brain wounds - - - 486
Cœliac actery, aneurysm of, case report 502
COHEN, SOL. M., and SCHULENBURG, C. A. R.: A case of arteriovenous aneurysm - - - 582
COLE, PERCIVAL P.: Experiences in reparative surgery of the upper limb - - - - - - 585
Coliform bacilli in tuberculous sinuses 417
Collagen deposition in scar tissue formation - - - - 437
— — — — — experimental - - 443
— — — — — vitamin C and - - 437
Collapse of lung, 'absorption' - - 407
— — bronchoscopy in - - - 409
COLLINS, DOUGLAS H., and PEARCE, T. VIBERT: Cartilaginous tumour of the shaft of the ulna - - 432
Colon, blood-supply of - - 347, 348
— cæcum, and rectum, 'simple' ulcers of - - - - - - - 575
— lower pelvic, resection of growths of 320
— — — — — discussion - - - 323
— — — — — illustrative cases - 323
— — — — — operation technique - 320
Conduction analgesia - - - - - 624
Congenital deformities of tibia - 102, 104
— malformations (*see* Malformations)
— polycystic disease of both kidneys, death from uræmia in, case report 500
Connective-tissue spaces of limbs, sarcoma of (*see* Sarcoma)
Contracture, Volkmann's ischæmia (*see* Volkmann's Ischæmic Contracture)
Contre-coup in lung injury in intact thorax - - - - - 41, 43
'Controlled respiration' in endotracheal anæsthesia - - - - - 621
Convulsions, ether - - - - - 620
Coronoid process in fractures of head and neck of radius - - - 110
Costotransversectomy in dumb-bell tumours of spine - - - - 568
PAGE
Cough in chondroma of bronchus 571, 574
Cranial nerves, paralysis of, in naso-pharyngeal carcinoma - 521, 523

Critical Reviews:—
Current practice in anæsthesia and analgesia - - - - - - 615
Septicæmia - - - - - - 124

Cutaneous gangrene, infective, in an infant, case report - - - 505
Cyanosis of hand in Volkmann's ischæmic contracture - - - - - 241
Cyclopropane as an anæsthetic - - 619
Cyst(s), epidermoid intramedullary, of spinal cord - - - - - 538
— formation with ruptured discoid lateral meniscus, case report - 135
— inclusion, of upper lip, case report 329
— intrathoracic, of intestinal structure, case report - - - - - 137
— pancreatic, treated by implantation into jejunum, case report - - 633
— retroperitoneal dermoid, case report 631

DAVIDSON, MAURICE: A case of primary chondroma of the bronchus - - - - - - 571
DE, M. N., and TRIBEDI, B. P.: Skeletal muscle tissue tumour - 17
Demographic factors in sacro-iliac tuberculosis - - - - - - 210
DENNISON, WALLACE M.: Delayed ossification of the tibia in apparent congenital absence - - 101
Dermis in wound healing, experimental 443
Dermoid cyst, retroperitoneal, case report - - - - - - 631
Desmoplast and desmoplasia - - 192
Dettol as an antiseptic - - - 475
— — in brain wounds - 486, 495, 496
— (modified) as an antiseptic in brain wounds - - - - - - 486
DEVENISH, EVERARD A., and JESSOP, W. H. GRAHAM: The nature and cause of swelling of the upper limb after radical mastectomy - 222
2 : 7 diaminoacridine hydrochloride as an antiseptic - - - - 475
— — — in brain wounds - - - 485
Dichloramine-T as an antiseptic - 475
Di-ethyl ether anæsthesia - - - 620
DIGBY, K. H., FOOK, WM. LAI, and YEUNG TSAW CHE: Nasopharyngeal carcinoma - - - - - 517
Diphtheroid bacilli in tuberculous sinuses - - - - - - 417
Discoid lateral meniscus of knee-joint, with rupture and cyst formation, case report - - - - - 135
Dislocation(s) of elbow in fractures of head and neck of radius - - 110
— and fracture-dislocations of the talus - - - - - - 88
— — — case report - - - - 88

PAGE

Dislocation(s) and fracture-dislocations of the talus, classification - - 92
— — — discussion - - - - 91
— — — mechanism of - - - 94
— — — summary - - - - 99
— — — symptoms and diagnosis - 94
— — — treatment - - - - 96
Diverticula, duodenal (*see* Duodenal Diverticula)
Diverticulitis, duodenal - - - 375
Di-vinyl ether anæsthesia - - - 620
DOOLIN, WILLIAM: An unusual fatality from uræmia, case report - 500
Dressing of tuberculous sinuses, secondary infection due to faulty technique - - - - 420
Droplet secondary infection of tuberculous sinuses - - - 421
Dumb-bell ganglioneuroma of chest - 608
— tumours of spine (*see* Spine)
Duodenal carcinoma associated with diverticula - - - - 377
— diverticula and complications - - 362
— — — case reports - - - 362
— — — discussion - - - - 370
— — — summary - - - - 377
— — stone extruded from, obstruction due to, case report - - 328
— diverticulitis - - - - - 375
— obstruction with diverticula - - 371
Duodenitis from duodenal diverticulum 376
Dysplasia, Streeter's fœtal - - - 174
Dysplastic lesions in mice - - - 189
Dyspnœa, bronchoscopy in - - 409

EAR, examination of, in nasopharyngeal carcinoma - - - - - 528
— symptoms in nasopharyngeal carcinoma - - - - - - 521
ECKOFF, NILS L.: Prolapse at umbilicus, case report - - - - - 628
Ectopic ureters - - - - - - 314
EDEN, KENNETH: Dumb-bell tumours of the spine - - - - 549
EDWARDS, HAROLD, and LEWIS, EVLYN E.: Leiomyomata of the stomach 284
Elbow, dislocation of, in fractures of head and neck of radius - - 110
— limitation by scar tissue of movement at, whole-thickness grafting in - - - - - - - - 605
Elmslie, Reginald Cheyne, obituary - 161
Embolic theory of neural damage after carotid ligation - - - 62
Embolism and arterial injury, Volkmann's contracture and - - - 249
— mesenteric (*see* Mesenteric Vascular Occlusion)
Emetine for *F. hepatica* infection in man 382
Emphysema of biliary passages - - 325
Endotracheal anæsthesia - - - 621
Enteroliths in duodenal diverticula - 377
Epicondylar injury in fractures of head and neck of radius - - - 108

PAGE

Epidermoid cyst, intramedullary, of spinal cord - - - - - 538
Epistaxis in nasopharyngeal carcinoma 521
Ether convulsions - - - - - 620
— di-ethyl, as anæsthetic - - - 620
— di-vinyl, as anæsthetic - - - 620
Ethyl chloride anæsthesia - - - 619
Ethylene as an anæsthetic - - - 619
Euflavine as an antiseptic - - - 474
— — in brain wounds - - - 484
Eunarcon as intravenous anæsthetic - 622
Eusol as an antiseptic in brain wounds 490
Evipan sodium as intravenous anæsthetic 622
Exophthalmos in nasopharyngeal carcinoma - - - - - 521, 523

Experimental Surgery:—
Antiseptics in brain wounds - 472
Expulsion of astragalus by trauma - 611
Extradural spinal analgesia - - - 625
Extraperitoneal intra-abdominal repair of inguinal hernia - - - 385
Extrathoracic aneurysm, disappearance of, case report - - - - 144
Eyelid to lip, congenital fissure from - 188

FACE, congenital malformations of (*see* Malformations)
Facial nerve paralysis in nasopharyngeal carcinoma - - - - - 525
— paralysis after parotidectomy 341 et seq.
FALCONER, MURRAY A., and HOOPER, REGINALD S.: Intramedullary epidermoid cyst of the spinal cord - - - - - - 538
— — and RUSSELL, DOROTHY S.: Antiseptics in brain wounds - 472
FALLON, MARTIN: Lung injury in the intact thorax - - - - - 39
Fascial graft in inguinal hernia (*see* Hernia, Inguinal)
Fasciola hepatica infection in man - 380
— — — — authors' case report - 382
— — — — cases from literature - 381
— — — — comment - - - 383
— — — — treatment - - - 382
Fauces in nasopharyngeal carcinoma - 525
Femur, osteomyelitis of - - - 266
Fibroblastoma, meningeal, dumb-bell - 554
— perineurial - - - - - - 554
Fibula, spontaneous fracture of (*see* Fracture, Spontaneous)
Field-blocking - - - - - - 624
Finger-tipping in reparative surgery - 595
Finger clefts, primary grafting of - 598
Fistula, jejunocolic, nutritional œdema as complication of - - - 468
— salivary, after parotidectomy - - 340
Fixation abscess in septicæmia - - 130
Flow meters for use in N_2O anæsthesia - - - - - - 619
Fœtal abnormalities (*see* Malformations)
— dysplasia, Streeter's - - - 174
Forearm muscles, sarcoma of - 4, 5, 6

PAGE

Foreign body impacted in œsophagus, non-malignant stricture following 279
FOOK, WM. LAI, DIGBY, K. H., and YEUNG TSAW CHE: Nasopharyngeal carcinoma - - - - 517
Foot, congenital malformations of (*see* Malformations)
Fracture-dislocations of talus (*see* Dislocations)
Fractures, incidence of Volkmann's ischæmic contracture following 240
— of radius, head and neck of - - 106
— — — — age incidence - - - 108
— — — — complications - - - 107
— — — — conclusions - - - 118
— — — — incidence and type - 106
— — — — mechanism of injury - 108
— — — — results of treatment - 113
— — — — treatment - - - 111
— spontaneous, of apparently normal fibula - - - - - - 82
— — — — — case reports - - 82
— — — — — discussion - - - 84
— — — — — summary - - - 86

GALL-BLADDER, cholesterosis of - 462
Gall-stones in duodenal diverticula 377
Ganglioneuromata, dumb-bell - - 556
— — of chest - - - - - - 608
Gangrene, cutaneous infective, in an infant, case report - - - 505
— of hands and feet in fœtus - - 177
Gastric ulcer, alkali poisoning in, case report - - - - - - 504
Gastrocnemius, secondary chorionepithelioma in - - - - - 10, 11
Gastro-intestinal diseases, sub-scurvy and - - - - - - - - 439
Gentian violet in *F. hepatica* infection in man - - - - - - 382
Glands, cervical, enlargement of, in nasopharyngeal carcinoma 521, 529
Glioma of brain in case of seminoma of abdominal testis - - - 357
Glossopharyngeal nerve paralysis in nasopharyngeal carcinoma - - 525
GORDON-TAYLOR, GORDON: On carotid tumours - - - - - - 163
— — On sarcoma of the muscles and the connective-tissue spaces of the limbs - - - - - 1
Gracilis muscle, sarcoma of - 10, 11
GRIFFITHS, D. LL.: Volkmann's ischæmic contracture - - - - - 239

HÆMANGIO-ENDOTHELIOMATA, dumb-bell - - - - - - 555
Hæmatogenous osteomyelitis, acute (*see* Osteomyelitis)
Hæmatoma, recurrence of inguinal hernia and - - - - - - - - 398
— subfascial, Volkmann's ischæmic contracture and - - - - - 247

PAGE

Hæmoptysis, bronchoscopy in - - 408
Hæmorrhagic infarction of bowel, pathological anatomy - - - - 350
Hæmothorax in lung injury in intact thorax - - - - - - 45
Halogen compounds as antiseptics - 474
— — — in brain wounds - - - 488
HANDLEY, W. SAMPSON: Excision of the body of the pancreas, case report - - - - - - - 143
HARRISON, C. V., and BENNETT-JONES, M. J.: Seminoma in an abdominal testis with a glioma of the brain - - - - - - 357
Head, congenital malformations of (*see* Malformations)
— position of, during bronchoscopy - 405
Headache in nasopharyngeal carcinoma 521, 523
Helium in inhalation anæsthesia - - 621
Hernia, inguinal, after-effects of operation - - - - - - - - 399
— — age incidence - - - - - 392
— — anæsthesia for operations for - 393
— — complications at and after operation - - - - - - - 394
— — fascial graft in - - - - - 384
— — — — details of operation - 387
— — — — discussion - - - 401
— — — — historical - - - 384
— — — — obtaining follow-up information - - - 388
— — — — statistics - - - 391
— — — — summary - - - 402
— — operative mortality - - - 393
— — possible methods of treatment - 384
— — recurrences after operation - 394
— — sex incidence - - - - - 391
— — type and side of hernia - - 392
HEWER, C. LANGTON: Current practice in anæsthesia and analgesia - 615
Hexobarbitone soluble as intravenous anæsthetic - - - - - 622
HIGGINS, L. G.: Infective cutaneous gangrene in an infant - - 505
HOOPER, REGINALD S., and FALCONER, MURRAY A.: Intramedullary epidermoid cyst of the spinal cord 538
Hospitalization in tuberculous cases with sinuses, effect of secondary infection - - - - - - - - 423
Humerus, condylar injury, in fractures of head and neck of radius - 108
HUNT, ALLAN H.: The role of vitamin C in wound healing - - - - 436
Hunter's canal, myxosarcoma arising in connective tissue of - - - 10
Hutchinson's 'potato' tumour of neck 165, 166
Hydrogen peroxide as an antiseptic - 476
— — — in brain wounds - - 492, 497
Hydrogen-ion concentrations of antiseptics, effect of - - 481, 494
Hypoglossal nerve paralysis in nasopharyngeal carcinoma - - 525

PAGE

Hypoproteinæmia, cellular proliferation and - - - - - - - 459
Hyoscine compounds in anæsthesia - 616

ILIUM, luxation upwards of, in sacro-iliac tuberculosis - - - 201
Immobilization in acute hæmatogenous osteomyelitis - - - - - 273
— tuberculous disease of ankle and tarsus - - - - - 77, 81
Inclusion cysts of upper lip, case report - - - - - - 329
Infant, cutaneous infective gangrene in, case report - - - - 505
Infective cutaneous gangrene in an infant, case report - - - 505
Infiltration analgesia - - - - 624
Infraclinoid aneurysms, carotid ligation in - - - - - - - 53
Infracolic spaces in drainage of peritoneal cavity - - 298, 299, 311
Infrahyoid muscles, wasting of, in naso-pharyngeal carcinoma - - 531
Infraspinatus, spindle-celled sarcoma of - - - - - - - 5
Inguinal hernia (*see* Hernia, Inguinal)
Inhalational anæsthesia, current practice 617
Injection treatment of inguinal hernia 385
Injury in aetiology of sarcoma of muscles - - - - - - 3

In Memoriam :—
Reginald Cheyne Elmslie, O.B.E. 161
Intestinal intrathoracic cyst, case report 137
Intestines, small, blood-supply of - 347
Intracranial aneurysm, saccular, carotid ligation in (*see* Carotid Ligation)
Intramedullary epidermoid cyst of spinal cord - - - - - - 538
Intraperitoneal effusions, spread of - 291
— — — anatomy of barriers of water-sheds - - - - - 291
— — — — drainage basins - - 293
— — — discussion - - - - - 307
— — — experimental investigations - 300
— — — summary - - - - - 312
Intrathoracic cyst of intestinal structure, case report - - - - 137
Intravenous anæsthesia - - - 622
Intussusception, persistent, in an adult 426
— — — case report - - - - 426
— — — — — anatomical note - 429
— — — commentary - - - 429
— — — summary - - - - 431
Iodoform as antiseptic - - - 475
Ischæmic contracture, Volkmann's (*see* Volkmann's Ischæmic Contracture)

JEJUNOCOLIC fistula, nutritional œdema as complication of - 468
Jejunum, pancreatic cyst treated by implantation into, case report - 633

PAGE

JESSOP, W. H. GRAHAM, and DEVENISH, EVERARD A.: The nature and cause of swelling of the upper limb after radical mastectomy - 222
Jugular vein, internal, thyroid carcinoma growing into, case report - - 634

KEITH, Sir ARTHUR: Concerning the origin and nature of certain malformations of the face, head, and foot - - - - - - 173
Keloid, low-voltage X-radiation in - 585
Kidney(s), bilateral congenital polycystic disease, death from uræmia in, case report - - - - - 500
— double, carcinoma of, with ectopia of one ureter - - - - 314
Knee-joint, discoid lateral meniscus of, with rupture and cyst formation, case report - - - - 135
— muscle tissue tumour at - - 24
KIRKMAN, N. F.: A case of persistent intussusception in an adult - 426

LAMINECTOMY in dumb-bell tumours of spine - - - - 566
Lateral meniscus of knee-joint, discoid, case report - - - - - 135
LE VAY, A. DAVID: Aneurysm of the cœliac artery, case report - - 502
Leg, sarcoma of muscles of - - 25
Leiomyomata of stomach - - - 284
— — case reports - - - - 284
— — commentary - - - - 288
— — summary - - - - - 290
LEWIS, EMLYN E., and EDWARDS, HAROLD: Leiomyomata of the stomach - - - - - - 284
Life tables for sacro-iliac tuberculosis 205
Limbs, sarcoma of muscles of (*see* Sarcoma)
Lip to eyelid, congenital fissure from - 188
— and mandible, congenital median cleft of - - - - - - - - 182
— upper, rare congenital malformation of, case report - - - - 329
Lipiodol, instillation into bronchi - 406
Lipoid resorption in cholesterosis of gall-bladder - - 462 et seq.
Liver changes with pancreatic necrosis in duodenal diverticula - 364, 370
— metastases in nasopharyngeal carcinoma - - - - - - 532
— rupture of, liver 'sequestrum' complicating - - - - - 544
— 'sequestrum' complicating subcutaneous rupture of liver - - 544
Lodge's method of obviating facial paralysis - - - - - - 341
Lung, 'absorption' collapse of - - 407
— collapse of, bronchoscopy in - - 409
— injury in the intact thorax - 39, 48
— — — — case report - - - 40

PAGE

Lung injury in the intact thorax, mechanism - - - - 41
— — — — — of injury - - - 41
— — — — morbid anatomy - - 43
— — — — sequelæ - - - - 47
— — — — symptomatology - - 45
— — — — treatment - - - 47
Lymphatic drainage in causation of swelling of arm after mastectomy 227
Lymph-glands, cervical, enlargement of, in nasopharyngeal carcinoma 521, 529

MACKEY, W. A.: Cholesterosis of the gall-bladder - - - - 462
Macrostoma - - - - - - 182
Malformation, congenital, of upper lip, case report - - - - 329
— of face, head, and foot - - - 173
— — — — club-foot - - - 191
— — — — congenital facial defects - 181
— — — — defects in the mid-dorsal line - - - - 179
— — — — dysplastic lesions in mice 189
— — — — Streeter's fœtal dysplasia 174
— — — — summary - - - 191
— — — — vascularization of external coverings of head - 178
Malignant change in mixed parotid tumours - - - - - - 30
Mandible and lip, congenital median cleft of - - - - - - 182
Manipulation in fractures of head and neck of radius - - - - 112
— reduction of dislocation of talus - 97
MANSON-BAHR, PHILIP, and WALTON, Sir JAMES: The surgical removal of *Fasciola hepatica* from the common bile-duct - - - 380
Mastectomy, swelling of arm after (*see* Upper Limb)
MCCURRICH, H. J.: Traumatic expulsion of the astragalus - - 611
MCGIBBON, JOHN E. G., and BAKER-BATES, E. T.: A bronchoscopic clinic - - - - - - 404
MCMILLAN, R. B.: Secondary infection in tuberculous sinuses - - 415
MCROBERT, G. R., and REDDY, D. GOVINDA: Disappearance of an extrathoracic aneurysm, case report 144
MEEKISON, D. M.: Discoid lateral meniscus of the knee-joint with rupture and cyst formation, case report - - - - - - 135
Meningeal fibroblastoma, dumb-bell - 554
Meningiomata, dumb-bell - - - 552
Meningoceles, formation of - - 180
Meniscus of knee-joint, lateral discoid, case report - - - - - 135
Mental deterioration due to alkali poisoning - - - - - - 504
Mercurochrome as an antiseptic - - 475
Merthiolate as an antiseptic - - 475
— — in brain wounds - - 491, 496

PAGE

Mesenteric arteries in blood-supply of intestines - - - - 347, 348
— vascular occlusion - - - - - 347
— — — aetiology - - - - - 350
— — — anatomy - - - - - 347
— — — author's series - - - 352
— — — clinical features - - - 351
— — — diagnosis, prognosis, treatment 352
— — — history - - - - - 347
— — — pathological anatomy - - 350
— — — results of - - - - 348
— — — summary - - - - - 355
Metaphen as an antiseptic - - - 475
— — in brain wounds - - - 490
Metastases from carotid gland tumour 164
— in sarcoma of muscles and connective-tissue spaces of limbs - 9
Mid-dorsal line, congenital defects in - 179
MITCHELL, G. A. G.: The spread of acute intraperitoneal effusions - 291
MITCHELL, W. R. D.: The end-results and treatment of tuberculous diseases of the ankle and tarsus - - - - - - 71
MOORE, THOMAS: Mesenteric vascular occlusion - - - - - - 347
Morison's pouch in spread of intraperitoneal effusions - - - 309
Morphine as sedative in anæsthesia - 615
MOTTERSHEAD, S., and BARLOW, T.: Anatomical note on a case of persistent intussusception in an adult - - - - - - 429
Mouth, examination of, in nasopharyngeal carcinoma - - - - 525
Multiple neurofibromata, dumb-bell - 554
MURRAY, R. C.: Fractures of the head and neck of the radius - - 106
Muscle(s) changes in Volkmann's ischæmic contracture - - - 243
— of limbs, sarcoma of (*see* Sarcoma)
— tissue tumour (*see* Skeletal Muscle Tissue Tumour)
Myoblastomas (*see also* Skeletal Muscle Tissue Tumour) 2
Myxosarcoma arising in connective tissue of Hunter's canal - - 10

NARCONUMAL as intravenous anæsthetic - - - - - - 622
Narcosis, basal, in anæsthesia - - 616
Nasal obstruction in nasopharyngeal carcinoma - - - - - 521
Nasopharyngeal carcinoma - - - 517
— — aetiology - - - - - 519
— — diagnosis - - - - - 518
— — pathology - - - - - 533
— — symptoms and signs - - - 521
— — treatment - - - - - 536
NAVASQUEZ, S. DE: Nutritional œdema as a complication of jejunocolic fistula - - - - - - 468
Neck, examination of, in nasopharyngeal carcinoma - - - - 528

PAGE

Nerve(s), cranial, paralysis of, in nasopharyngeal carcinoma - 521, 523
— injury in Volkmann's ischæmic contracture - - - - - - 246
Nerve-blocking - - - - - - 624
Neural damage following carotid ligation in intracranial aneurysm - - 62
Neuralgia in nasopharyngeal carcinoma 521, 523
Neurofibromata, dumb-bell - - 522
Neurofibromatosis, von Recklinghausen's, scoliosis in - - - - - 564
NICHOLLS, M. F.: Intrathoracic cyst of intestinal structure, case report 137
Nitrous oxide in anæsthesia and analgesia 618
Nose, examination of, in nasopharyngeal carcinoma - - - - - 525
Novocain as a local analgesic - - 624
— spinal analgesic - - - - - 625
Nutritional œdema as a complication of jejunocolic fistula - - - 468

OCULOMOTOR nerve paralysis in nasopharyngeal carcinoma - - 523
Œdema, nutritional, as a complication of jejunocolic fistula - - 468
Œsophagus, non-malignant stricture of 275
OGILVIE, ROBERTSON F.: Duodenal diverticula and their complications - - - - - - 362
Omnopon as sedative in anæsthesia - 616
Optic atrophy in nasopharyngeal carcinoma - - - - - - 523
Orchidopexy, malignancy and - - 358
Oro-temporal cleft, congenital - - 183
Oscillometer of Pachon - - - 242
Ossification of tibia (*see* Tibia)
Osteomyelitis, acute hæmatogenous - 261
— — — bacteriology - - - 263
— — — bones affected - - - 265
— — — complications - - - 268
— — — follow-up statistics - - 269
— — — incidence - - - - 261
— — — mortality - - - - 264
— — — primary operations - - 267
— — — — septic focus in - - 262
— — — radiography in diagnosis - 263
— — — secondary operations - - 268
— — — summary - - - - 273
— — — trauma in - - - - 262
— — — treatment - - - - 271

PACHON, oscillometer of - - 242
Pain in sacro-iliac tuberculosis - 194
— Volkmann's ischæmic contracture - 241
Palate to tongue, fibrous band from - 188
Pallor of hand in Volkmann's ischæmic contracture - - - - - 241
Pancreas, excision of body of, case report 143
Pancreatic cyst treated by implantation into jejunum, case report - - 533
— duct obstruction in duodenal diverticula - - - - - - 372

PAGE

Pancreatic necrosis in duodenal diverticula (*see* Duodenal Diverticula and Complications)
Pancreatico-duodenal artery in blood-supply of colon - - - - - 348
Papaverine injection in prevention of Volkmann's contracture - 253, 257
Paracolic groove in spread of intraperitoneal effusions - - 310, 311
Paraldehyde as basal narcotic in anæsthesia - - - - - - 616
Paralysis of cranial nerves in nasopharyngeal carcinoma - - - 521, 523
— facial, after parotidectomy 341 et seq.
Parenchymal rupture in lung injury in intact thorax - - - - - 45
Parotid gland, tumours of - - - 337
— — — case reports - - - 343
— — — essential modifications of current teaching - - - 337
— — — mixed, conclusions - - 37
— — — — course following treatment 31
— — — — expectant treatment - 32
— — — — irradiation of - - - 34
— — — — natural course of disease 29
— — — — radical removal - - 33
— — — — surgery combined with irradiation in - - 36
— — — — treatment - - - 29
— — — — — various forms - - 32
— — — technique of total parotidectomy - - - - - 341
Parotidectomy, total, technique of - 341
PATERSON, DONALD, and PILCHER, ROBIN S.: Dumb-bell ganglioneuroma of chest - - - 608
PATEY, DAVID H.: The treatment of mixed tumours of the parotid gland - - - - - - 29
PEARCE, T. VIBERT, and COLLINS, DOUGLAS H.: Cartilaginous tumour of the shaft of the ulna 432
Pectoralis major, wasting of, in nasopharyngeal carcinoma - - 531
Pelvic colon (*see* Colon)
— space in drainage of peritoneal cavity 299, 311
Pelvis, metastases in, in nasopharyngeal carcinoma - - - 531, 533
— osteomyelitis of - - - - 265
Pentothal sodium as intravenous anæsthetic - - - - - - 622
Percaine spinal anæsthesia for repair of inguinal hernia - - - 393
— as a spinal analgesic - - - 625
Perforation of perivaterine diverticulum 376
Peridiverticulitis, duodenal - - - 376
Perineurial fibroblastoma - - - 554
Perivaterine diverticula (*see* Duodenal Diverticula and Complications)
Permeation analgesia - - - - 624
Phagocytosis in wound healing, experimental - - - - - - 445
Phenyl mercuric nitrate as an antiseptic 476
— — — — in brain wounds - - 492

PAGE

PILCHER, ROBIN S., and PATERSON, DONALD: Dumb-bell ganglio-neuroma of chest - - - 608
Plasma proteins, œdema and - - 468
Plasmaphoresis, œdema and ascites due to - - - - - - - - 468
Pneumococcal septicæmia (*see* Septicæmia)
Pneumonia, unresolved, bronchoscopy in - - - - - - - - 410
Pneumonitis, bronchoscopy in - - 410
Pneumothorax type of lung injury in intact thorax - - - 44, 46
Poisoning, alkali, in gastric ulcer, case report - - - - - - 504
Potato tumour of neck, Hutchinson's 165, 166
Pregnancy, sacro-iliac tuberculosis and 213
PRINGLE, SETON: Resection of growths of the lower pelvic colon - - 320
Proflavine as an antiseptic - - - 474
— — in brain wounds - 484, 495, 496
Prolapse at umbilicus, case report - 628
Prontosil soluble in septicæmia - - 133
Proptosis of eyeball in nasopharyngeal carcinoma - - - - - 523
Proteins in œdema fluid in swelling of arm after mastectomy - - 224
— plasma, œdema and - - - 468
Psychic shock, local analgesia and - 623
Ptosis in nasopharyngeal carcinoma - 523
Pulmonary neoplasms, bronchoscopy in 411
— suppuration, bronchoscopy in - 410
Pulse in Volkmann's ischæmic contracture - - - - - - - - 241
Pus from bronchi, removal of uncontaminated specimens - - 406

QUESTIONNAIRE for follow-up in hernia cases - - - - - 390

RADCLIFFE, WALTER: Rare congenital malformation of the upper lip, case report - - - 329
Radiotherapy (*see* Radium Therapy; X-ray Therapy)
Radon, bronchoscopic insertion of - 413
Radium therapy in mixed tumours of parotid - - - - - 34, 36
— — in sarcoma of muscles of limbs - 12
Radius, fractures of (*see* Fractures)

Rare Cases :—

A case of retroperitoneal dermoid cyst - - - - - - - - 631
Alkali poisoning in a case of gastric ulcer - - - - - - - 504
An unusual cause of intestinal obstruction - - - - - 328
An unusual fatality from uræmia - 500
Aneurysm of the cœliac artery - 502
Carcinoma of the thyroid gland growing into the internal jugular vein - - - - - - 634

PAGE

Rare Cases, *contd.*:—
Disappearance of an extrathoracic aneurysm - - - - - - 144
Discoid lateral meniscus of the knee-joint with rupture and cyst formation - - - - - 135
Excision of the body of the pancreas 143
Intrathoracic cyst of intestinal structure - - - - - - 137
Pancreatic cyst treated by implantation into the jejunum - - 633
Prolapse at the umbilicus - - 628
Rare congenital malformation of the upper lip - - - - - 623
Reaction (*see* Test)
Rectum, cæcum, and colon, 'simple' ulcers of - - - - - - 575
Rectus femoris, sarcoma of - - 6
REDDY, D. GOVINDA, and MCROBERT, G. R.: Disappearance of an extrathoracic aneurysm, case report 144
Respiration, 'controlled', in endotracheal anæsthesia - - - - - 621
Retroperitoneal dermoid cyst, case report 631

Reviews and Notices of Books :—

The art of surgery (H. S. Souttar) 638
Berkeley Moynihan, Surgeon (D. Bateman) - - - - - - 331
Bone graft surgery in disease, injury, and deformity (F. H. Albee and A. Kushner) - - - - - 639
Cancer in childhood (H. W. Dargeon) 334
Cancer of the colon and rectum (F. W. Rankin and A. S. Graham) - 513
Common mistakes of surgery in India and how to avoid these (Lt.-Col. A. N. Palit) - - 643
Cura operatoria della fratture del collo del femora (V. Putti) - 152
Cyclopropane anæsthesia (B. H. Robbins) - - - - - - 334
Demonstrations of physical signs in clinical surgery (H. Bailey) - 150
A descriptive atlas of radiographs (A. P. Bertwistle) - - - - 156
Diseases of the foot (E. D. W. Hauser) 153
Diseases of the urethra and penis (E. D'A. McCrea) - - - 642
The early diagnosis of the acute abdomen (Z. Cope) - - - 150
El pie talo poliomielítico y su tratamiento (V. S. Olmos) - - 154
Emergency surgery (H. Bailey) - 510
Field surgery in total war (D. W. Jolly) - - - - - - 509
Fisiopatologia del hepato-colédoco (P. L. Mirizzi) - - - - 156
Fractures (G. Perkins) - - - 639
Fractures and dislocations for practitioners (E. O. Geckeler) - - 332
Fractures and other bone and joint injuries (R. Watson-Jones) - 639
Handbook of orthopædic surgery (A. R. Shands and R. B. Raney) 152

PAGE

Reviews and Notices of Books, *contd.*:—
A handbook of radiography (J. A. Ross) - - - - - - 335
The head and neck in roentgen diagnosis (H. K. Pancoast et al.) 515
Hospital for the ruptured and crippled (F. Beekman) - - 158
Illustrations of surgical treatment, instruments and appliances (E. L. Farquharson) - - - - - 157
Injuries of the jaws and face (W. W. James and B. W. Fickling) - 640
Injuries of the skull, brain, and spinal cord (S. Brock) - - - - 512
Localisations viscérales et aspects chirurgicaux des brucelloses (R. Michel-Bechet, R. Puig, and P. Charvet) - - - - - 156
The Macewen outlook in surgery (G. G. Turner) - - - - 158
Malignant disease and its treatment by radium (S. Cade) - - 508
Minor surgery (R. J. McN. Love) 149
A mirror for surgeons (Sir D'Arcy Power) - - - - - - 157
Operative surgery (J. S. Horsley and I. A. Bigger) - - - 332
Orthopædic operations (A. Steindler) 515
The pineal organ (R. J. Gladstone and C. P. G. Wakeley) - - 335
Pye's surgical handicraft (ed. H. Bailey) - - - - - - 332
Relation of trauma to new growths (R. J. Behan) - - - - - 155
Rose and Carless' manual of surgery (C. P. G. Wakeley and J. B. Hunter) - - - - - - 331
Sclerosing therapy (ed. F. C. Yeomans) - - - - - 155
Surface anatomy (W. E. Roberts) - 151
The surgery of the alimentary tract (Sir Hugh Devine) - - - 148
Surgery of the hand (J. H. Couch) 154
Surgery of the hand (R. M. Handfield-Jones) - - - - - 512
Surgery of modern warfare (ed. H. Bailey) - - - - - 637
Synopsis of operative surgery (H. E. Mobley) - - - - - - 511
A synopsis of surgery (E. W. Hey Groves) - - - - - - 149
Synopsis of surgical anatomy (A. L. McGregor) - - - - - 150
The synovial membrane and the synovial fluid (D. H. Kling) - 153
Theory and treatment of fractures of the jaws in peace and war (H. H. Boyle) - - - - - 334
Treatment of cancer and allied diseases (G. T. Pack and E. M. Livingston) - - - - - 642
Tuberculosis of bone and joint (G. R. Girdlestone) - - - - - 151
War wounds and injuries (ed. E. Fletcher and R. W. Raven) - 509

PAGE

Reviews and Notices of Books (Authors):—
Albee, F. H., and Kushner, A.: *Bone graft surgery in disease, injury, and deformity* - - 639
Bateman, D.: *Berkeley Moynihan, Surgeon* - - - - - - 331
Beekman, F.: *Hospital for the ruptured and crippled* - - 158
Bertwistle, A. P.: *A descriptive atlas of radiographs* - - - 156
Bailey, H.: *Demonstrations of physical signs in clinical surgery* 150
Bailey, H.: *Emergency surgery* - 510
Bailey, H.: *Pye's surgical handicraft* (ed.) - - - - - 332
Bailey, H.: *Surgery of modern warfare* (ed.) - - - - - 637
Behan, R. J.: *Relation of trauma to new growths* - - - - - 155
Bigger, I. A., and Horsley, J. S.: *Operative surgery* - - - 332
Boyle, H. H.: *Theory and treatment of fractures of the jaws in peace and war* - - - - - 334
Brock, S.: *Injuries of the skull, brain, and spinal cord* - - 512
Cade, S.: *Malignant disease and its treatment by radium* - - 508
Charvet, P., et al.: *Localisations viscérales et aspects chirurgicaux des brucelloses* - - - - - 156
Cope, Z.: *The early diagnosis of the acute abdomen* - - - - 150
Couch, J. H.: *Surgery of the hand* 154
Dargeon, H. W.: *Cancer in childhood* - - - - - - 334
Devine, Sir Hugh: *The surgery of the alimentary tract* - - - 148
Farquharson, E. L.: *Illustrations of surgical treatment, instruments and appliances* - - - - - 157
Fickling, B. W., and James, W. W.: *Injuries of the jaws and face* - 640
Fletcher, E., and Raven, R. W.: *War wounds and injuries* (ed.) - 509
Geckeler, E. O.: *Fractures and dislocations for practitioners* - 332
Girdlestone, G. R.: *Tuberculosis of bone and joint* - - - - 151
Gladstone, R. J., and Wakeley, C. P. G.: *The pineal organ* - 335
Graham, A. S., and Rankin, F. W.: *Cancer of the colon and rectum* - 513
Groves, E. W. Hey: *A synopsis of surgery* - - - - - 149
Handfield-Jones, R. M.: *Surgery of the hand* - - - - - 512
Hauser, E. D. W.: *Diseases of the foot* - - - - - - - 153
Horsley, J. S., and Bigger, I. A.: *Operative surgery* - - - - 332
Hunter, J. B., and Wakeley, C. P. G.: *Rose and Carless' manual of surgery* - - - - - 133

PAGE

Reviews and Notices of Books, *contd.*:—
James, W. W., and Fickling, B. W.: *Injuries of the jaws and face* - 640
Jolly, D. W.: *Field surgery in total war* - - - - - - - 509
Kling, D. H.: *The synovial membrane and the synovial fluid* - 153
Kushner, A., and Albee, F. H.: *Bone graft surgery in disease, injury, and deformity* - - 639
Livingston, E. M., and Pack, G. T.: *Treatment of cancer and allied diseases* - - - - - - 642
Love, R. J. McN.: *Minor surgery* 149
McCrea, E. D'A.: *Diseases of the urethra and penis* - - - - 642
McGregor, A. L.: *Synopsis of surgical anatomy* - - - 150
Michel-Bechet, R., et al.: *Localisations viscérales et aspects chirurgicaux des burcelloses* - - 156
Mirizzi, P. L.: *Fisiopatologia del hepato-colédoco* - - - - - 156
Mobley, H. E.: *Synopsis of operative surgery* - - - - - 511
Olmos, V. S.: *El pie talo poliomielitico y su tratamiento* - - 154
Pack, G. T., and Livingston, E. M.: *Treatment of cancer and allied diseases* - - - - - - 642
Palit, Lt.-Col. A. N.: *Common mistakes of surgery in India and how to avoid these* - - - 643
Pancoast, H. K., et al.: *The head and neck in roentgen diagnosis* - 515
Pendergrass, E. P., at al.: *The head and neck in roentgen diagnosis* 515
Perkins, G.: *Fractures* - - 639
Power, Sir D'Arcy: *A mirror for surgeons* - - - - - - 157
Puig, R., et al.: *Localisations viscérales et aspects chirurgicaux des brucelloses* - - - - - 156
Putti, V.: *Cura operatoria della fratture del collo del femora* - 152
Raney, R. B., and Shands, A. R.: *Handbook of orthopædic surgery* 152
Rankin, F. W., and Graham, A. S.: *Cancer of the colon and rectum* - 513
Raven, R. W., and Fletcher, E.: *War wounds and injuries* (ed.) - 509
Robbins, B. H.: *Cyclopropane anæsthesia* - - - - - 334
Roberts, W. E.: *Surface anatomy* 151
Ross, J. A.: *A handbook of radiography* - - - - - - 335
Schæffer, J. P., et al.: *The head and neck in roentgen diagnosis* - 515
Shands, A. R., and Raney, R. B.: *Handbook of orthopædic surgery* 152
Souttar, H. S.: *The art of surgery* 638
Steindler, A.: *Orthopædic operations* - - - - - - 515
Turner, G. G.: *The Macewen outlook in surgery* - - - - - 158

PAGE

Reviews and Notices of Books, *contd.*:—
Wakeley, C. P. G., and Gladstone, R. J.: *The pineal organ* - - 335
Wakeley, C. P. G., and Hunter, J. B.: *Rose and Carless' manual of surgery* - - - - - 331
Watson-Jones, R.: *Fractures and other bone and joint injuries* - 639
Yeomans, F. C.: *Sclerosing therapy* (ed.) - - - - - - 155
Rhabdomyomas (*see also* Skeletal Muscle Tissue Tumour; Sarcoma of Muscles) - - - - - - 2
— of gracilis muscle - - - - 11
Richard's operation in sacro-iliac tuberculosis - - - - - 217, 218
Rivanol as an antiseptic - - - 474
Ross, J. PATERSON: Carcinoma of the thyroid gland growing into the internal jugular vein, case report 634
Rotter's intradermal dye test in vitamin C deficiency - - - - - 448
Rubiazol in septicæmia - - 131, 132
Rupture of liver, liver 'sequestrum' complicating - - - - - 544
Ruptured discoid lateral meniscus, case report - - - - - - 135
RUSSELL, DOROTHY S., and FALCONER, MURRAY A.: Antiseptics in brain wounds - - - - - - 472

SACCULAR intracranial aneurysms, carotid ligation in (*see* Carotid Ligation)
Sacro-iliac tuberculosis - - - 193
— — chief features of the disease - 193
— — material - - - - - - 193
— — prognosis - - - - - - 205
— — summary - - - - - - 220
— — treatment - - - - - - 214
Salivary fistula after parotidectomy - 340
Sarcoma of muscle of leg - - - 25
— muscles (*see also* Skeletal Muscle Tissue Tumours)
— — and connective-tissue spaces of limbs - - - - - - 1
— — — — — age and sex incidence 3
— — — — — clinical aspects - - 7
— — — — — conclusions - - 15
— — — — — diagnosis - - - 9
— — — — — frequency - - - 1, 5
— — — — — injury as aetiological factor - - - 3
— — — — — prognosis - - - 11
— — — — — treatment - - - 12
Sartorius, sarcoma of - - - - 7
Scaphoid, tuberculous osteitis of - 75
Scar tissue, collagen deposition in - 437
— — — — experimental - - - 443
SCHORSTEIN, JOSEPH: Carotid ligation in saccular intracranial aneurysms 50
SCHULENBURG, C. A. R., and COHEN, SOL. M.: A case of arteriovenous aneurysm - - - - - 582

PAGE

Scoliosis in neurofibromatosis of spine 564
Scopolamine as sedative in anæsthesia 615
Scurvy, effect on healed wounds, experimental - - - - - - 446
— sub- or asymptomatic - - - 438
— wound healing and - - - 437
Sedation in anæsthesia - - - 615
SEDDON, H. J., and STRANGE, F. G. ST. CLAIR: Sacro-iliac tuberculosis 193
Seminoma in abdominal testis, with a glioma of the brain - - - 357
— epididymis - - - - - 120
— of testis and aortic gland - - 120
Septicæmia - - - - - 124
— diagnosis - - - - - 127
— effects of modern treatment - - 133
— pathology - - - - - 125
— portals of entry and types of bacteria - - - - - 124
— prognosis - - - - - 128
— treatment - - - - - 129
Sequestrectomy in acute osteomyelitis - 267
Serum albumin, œdema and - - 468
— therapy in septicæmia - - - 130
Sex incidence of carotid tumours - 164
— — inguinal hernia - - - 391
— — nasopharyngeal carcinoma - 519
— — sacro-iliac tuberculosis - - 194
— — sarcoma of muscles - - - 3
— — secondary infection in tuberculous sinuses - - - - - 415
SHAW, J. J. M.: An unusual cause of intestinal obstruction, case report 328
Shock, psychic, local analgesia and - 623
Shoulder, limitation by scar tissue of movement at, whole-thickness grafting in - - - - - 606
'Simple' ulcers of cæcum, colon, and rectum - - - - - - 575
Sinus(es) formation in sacro-iliac tuberculosis - - - - 195, 207
— — tuberculous disease of ankle and tarsus - - - - - 75, 77
— tuberculous (*see* Tuberculous Sinuses)
Skeletal muscle tissue tumour - - 17
— — — — case reports - - - 17
— — — — discussion and comments 27
— — — — summary and conclusions 28
Skin infection of tuberculous sinuses - 420
— temperature in Volkmann's ischæmic contracture - - - - 242
Skin-grafting in reparative surgery of upper limb - - 585 et seq.
Smell, loss of sense of, in nasopharyngeal carcinoma - - - - 528
Smith-Petersen's operation in sacro-iliac tuberculosis - - 217, 218
Sodium thioethamyl as intravenous anæsthetic - - - - 622
Soluseptasine (M & B 137) as an antiseptic - - - - - 476
— — in brain wounds - - 492, 497
— in septicæmia - - - - 133
Soot-laden atmosphere in aetiology of nasopharyngeal carcinoma - 519

PAGE

Speech affected in nasopharyngeal carcinoma - - - - - 525
Spinal anæsthesia in mesenteric vascular occlusion - - - - - 352
— — for repair of inguinal hernia - 393
— analgesia - - - - - 625
— — therapeutic and diagnostic uses 626
— cord, intramedullary epidermoid cyst of - - - - - - 538
— lesions in sacro-iliac tuberculosis - 199
— metastases in nasopharyngeal carcinoma - - - - 531, 533
Spine, dumb-bell tumours of - - 549
— — — anatomical types - - - 549
— — — clinical features - - - 558
— — — incidence of pathological types 549
— — — pathological histology and mode of origin - - 552
— — — scoliosis in - - - - 564
— — — summary - - - - 568
— — — treatment - - - - 564
— von Recklinghausen's neurofibromatosis, scoliosis in - - - 564
Spontaneous fracture of apparently normal fibula (*see* Fracture)
Squint in nasopharyngeal carcinoma - 523
S.T.37 as antiseptic in skin-grafting operations on arm - - - 601
Staphylococcal infection in tuberculous sinuses - - - - - - 416
— septicæmia (*see* Septicæmia)
Staphylococcus in acute hæmatogenous osteomyelitis - - - - 263
STEEL, JOHN P., and WHITAKER, P. H.: Emphysema of the biliary passages 325
Stent cast in reparative surgery of upper limb - - - - - 592
Sternomastoid, wasting of, in nasopharyngeal carcinoma - - 529
Stomach, leiomyomata of - - - 284
— — case reports - - - - 284
— — commentary - - - - 288
— — summary - - - - - 290
Stovaine as spinal analgesic - - 625
STRANGE, F. G. ST. CLAIR, and SEDDON, H. J.: Sacro-iliac tuberculosis 193
Strawberry gall-bladder - - - 462
Streeter's fœtal dysplasia - - - 174
Streptococcal infection in tuberculous sinuses - - - - - - 416
Streptococci in acute hæmatogenous osteomyelitis - - - - - 263
Streptococcus hæmolyticus in septicæmia (*see* Septicæmia)
Stricture, non-malignant, of œsophagus 275
Subarachnoid spinal analgesia - - 625
Subastragaloid, tuberculous arthritis of 74
Subcutaneous rupture of liver, liver 'sequestrum' complicating - 544
Subfascial hæmatoma, Volkmann's ischæmic contracture and - - 247
Subhepatic spaces in drainage of peritoneal cavity - 296, 297, 302 et seq.
Subphrenic spaces in drainage of peritoneal cavity - - - 294, 311

PAGE

Sub-scurvy - - - - - - 438
Suction apparatus for use during endoscopy - - - - 406
Sulphanilamide as an antiseptic in brain surgery - - - - 476, 497
— in septicæmia - 130, 131, 132, 133
Sulphapyridine in septicæmia 131, 132, 133
Sulphathiazole in septicæmia 131, 132, 133
Sulphonamides as antiseptics in brain surgery - - - - - 476
— in septicæmia - - - - 130
— wound healing - - - - 459
Sunlight in treatment of tuberculous disease of ankle and tarsus - - 77
Supernumerary ureters - - - 314
Supersan as an antiseptic - - - 475
— — in brain wounds - 487, 495, 496
Supraclinoid aneurysms, carotid ligation in - - - - - - 55
Supracolic space in drainage of peritoneal cavity - - - - 293
Suppuration, pulmonary, bronchoscopy in - - - - - - 410
— in recurrence of inguinal hernia - 398
Suppurative arthritis in acute hæmatogenous osteomyelitis - - 268
Surface analgesia - - - - 624
Swelling of arm after radical mastectomy (*see* Upper Limb)
Synovial tuberculous disease of ankle and tarsus - - - - 74
Szent-Györgyi's test in vitamin-C deficiency - - - - - 448

TALUS (*see also* Ankle)
— dislocations and fracture-dislocations of (*see* Dislocations)
— traumatic expulsion of - - - 611
Tarsus and ankle, tuberculous disease of, end-results and treatment - 71
— — — — — — adults - - - 77
— — — — — — children - - 72
Temperature of skin in Volkmann's ischæmic contracture - - - 242
Temporal region in nasopharyngeal carcinoma - - - - 523
Test, Rotter's intradermal dye, in vitamin-C deficiency - - - - 448
— Szent-Györgyi's, in vitamin-C deficiency - - - - - 448
— Zondek-Aschheim, in testicular tumours - - - - - 358
Testicular tumours - - - - 119
— — case of chorionepithelioma testis 122
— — — seminoma epididymis - - 121
— — diagnosis - - - - - 119
— — summary - - - - - 123
— — treatment - - - - - 120
Testis, abdominal, seminoma in, with glioma of the brain - - 357
Thiersch grafting, primary, in reparative surgery of upper limb - - 597
— — secondary, in reparative surgery of upper limb - - - 601

PAGE

Thigh graft in repair of inguinal hernia (*see* Hernia, Inguinal, Fascial Graft in)
— muscles, sarcoma of - - 5 et seq.
Thoracic surgery, cyclopropane anæsthesia in - - - - - - 619
Thoracotomy in dumb-bell tumours of spine - - - - - - 568
Thorax, intact, lung injury in (*see* Lung Injury)
Thrombosis, mesenteric (*see* Mesenteric Vascular Occlusion)
Thyroid carcinoma growing into internal jugular vein, case report - - 634
Tibia, congenital absence of - - 104
— delayed ossification of, in apparent congenital absence - - - 101
— — — — — — case report - - 101
— — — — — — conclusions - - 105
— — — — — — summary - - 105
Tongue, examination of, in nasopharyngeal carcinoma - - - - - 525
— to palate, fibrous band from - - 188
Tonicity of antiseptics, effect of variations on - - - - 481, 494
Toxæmia in acute osteomyelitis, treatment of - - - - - - 271
Trapezius, wasting of, in nasopharyngeal carcinoma - - - - - 529
Traumatic expulsion of astragalus - 611
TRIBEDI, B. P., and DE, M. N.: Skeletal muscle tissue tumour - - 17
Triceps, sarcoma of - - - - - 6
Trigeminal nerve paralysis in nasopharyngeal carcinoma - - 523
Tuberculin in treatment of tuberculous disease of ankle and tarsus - 77
Tuberculosis, sacro-iliac (*see* Sacro-iliac Tuberculosis)
Tuberculous disease of ankle and tarsus, end-results and treatment - - 71
— — — — — — adults - - - 77
— — — — — — children - - 72
— sinuses, secondary infection in - 415
— — — — clinical effect - - - 421
— — — — nature of organisms - 416
— — — — summary - - - 424
— — — — time of onset and mode of ingress - - - 418
Tumour(s) (*see also under specific types*)
— bronchial, removal of portion by bronchoscope for histological examination - - - - - 406
— carotid (*see* Carotid)
— cartilaginous, of ulnar shaft - - 432
— of lower pelvic colon, resection of (*see* Colon)
— parotid gland (*see* Parotid)
— 'potato', Hutchinson's - - 165, 166
— pulmonary, bronchoscopy in - - 411
— of spine (*see* Spine)
— testicular (*see* Testicular Tumours)
TURNER, G. GREY: Two cases of non-malignant stricture of the œsophagus - - - - - - 275

PAGE

ULCER, gastric, alkali poisoning in, case report - - - - 504
— 'simple', of cæcum, colon, and rectum - - - - - 575
Ulna, coronoid process of, in fractures of head and neck of radius - 110
— shaft of, cartilaginous tumour of - 432
Umbilicus, prolapse at, case report - 628
Undescended testis, seminoma in, with glioma of brain - - - 357
Upper limb, reparative surgery of - 585
— — sarcoma of forearm muscles 4, 5, 6
— — swelling of, after radical mastectomy - - - - - 222
— — — — — — cause of swelling - 225
— — — — — — discussion - - 234
— — — — — — lymphatic drainage in causation of - 227
— — — — — — nature of swelling 222
— — — — — — summary - - 238
— — — — — — venous pressure as cause of - - 225
— lip, rare congenital malformation of, case report - - - - 329
Uræmia, an unusual fatality from, case report - - - - - 500
Ureters, supernumerary and ectopic - 314

VASCULAR nerves, neural damage after carotid ligation and - - 65
Vascularization of external coverings of head - - - - - 178
Vein, internal jugular, thyroid carcinoma growing into, case report - 634
Venesetic as intravenous anæsthetic - 622
Venous mesenteric occlusion - - 351
— obstruction in Volkmann's ischæmic contracture - - - - 247
— pressure in causation of swelling of arm after mastectomy - - 225
Verrall's operation in sacro-iliac tuberculosis - - - - 217, 218
Vinesthene anæsthesia - - - 620
Vitamin C deficiency, assessing degree of in animals - - - - 447
— in wound healing - - - - 436
— — — administration - - - 460
— — — animal experiment - - 439
— — — discussion and conclusions - 457
— — — human experiment - - 450
— — — — necropsy material - - 452
— — — illustrative case records - 456
— — — investigation - - - 439
— — — relationship to collagen production - - - - 437
— — — summary - - - - 460
Volkmann's ischæmic contracture - 239
— — — clinical features - - - 241
— — — diagnosis - - - - 245
— — — experimental production of - 254
— — — morbid anatomy - - - 243
— — — pathogenesis - - - 246
— — — prognosis - - - - 258
— — — summary and conclusions - 258

PAGE

Volkmann's ischæmic contracture, treatment - - - - - - 255
von Recklinghausen's neurofibromatosis, scoliosis in - - - - - 564

WALTON, Sir JAMES, and MANSON-BAHR, PHILIP: The surgical removal of *Fasciola hepatica* from the common bile-duct - - 380
Water-cress as vector in *F. hepatica* infection - - - - - - 380
WHITAKER, P. H., and STEEL, JOHN P.: Emphysema of the biliary passages 325
WHITBY, L. E. H.: Septicæmia - 124
WIGHAM, J. R. M.: Alkali poisoning in gastric ulcer, case report - 504
WILLIAMS, Surg.-Comdr. E. R. P.: A case of retroperitoneal dermoid cyst, case report - - - 631
WILLIAMSON, J. C. F. LLOYD: The use of fascial graft in the cure of inguinal hernia - - - 384
Willis, circle of, neural damage after carotid ligation and - - - 65
Wilm's phenomenon in lung injury in intact thorax - - - - 46
Wolfe grafting, primary, in reparative surgery of upper limb - - 591
Work, capacity for, after sacro-iliac tuberculosis - - - - - 212
Wound(s), brain, antiseptics in (*see* Antiseptics)
— healing, cellular proliferation in - 436
— — collagen deposition in scar tissue 437
— — vitamin C in (*see* vitamin C)
— prophylaxis against septicæmia - 129

X-RADIATION, low-voltage, in keloid - - - - - - 585
X-ray appearances in acute hæmatogenous osteomyelitis - 266 et seq.
— — angiography in infraclinoid aneurysm - - - - - - 55
— — of cartilaginous tumour of ulnar shaft - - - - - - 432
— — in cholesterosis of gall-bladder - 463
— — chondroma of bronchus - - 571
— — of chorioma testis - - - 122
— — in delayed ossification of tibia 101, 102
— — double kidney - - - - 314
— — of dumb-bell ganglioneuroma - 556
— — — — of chest - - - - 608
— — — tumours of spine 556, 559, 561, 565
— — duodenal diverticulum - - - 329
— — in emphysema of biliary passages 326
— — epidermoid cysts of spinal cord 539
— — fracture of head and neck of radius - - - 109 et seq.
— — fracture-dislocations of talus 89 et seq.
— — intrathoracic aneurysm - - 145

PAGE

X-ray appearances in intrathoracic cyst of intestinal origin - - 137, 138
— — ischæmic contracture caused by fracture of humerus - - 256
— — leiomyomata of stomach 284, 286, 287
— — lung injury in intact thorax - 40
— — of metastases in nasopharyngeal carcinoma - - - - 532
— — in muscle tissue tumour at knee-joint - - - - - 23
— — non-malignant stricture of œsophagus - - - - 276, 280
— — rupture of liver complicated by 'sequestrum' - - - 545
— — sacro-iliac tuberculosis - - 199
— — spontaneous fracture of apparently normal fibula - 83, 85
— — swelling of arm after mastectomy - - - 224
— — traumatic expulsion of astragalus 611
— — tuberculous disease of ankle and tarsus - - - 73 et seq.
— therapy in carotid gland tumours - 165
— — mixed tumours of parotid 34, 36
— — sarcoma of muscles of limbs - 12

YEUNG TSAW CHE, DIGBY, K. H., and FOOK, WM. LAI: Nasopharyngeal carcinoma - - 517

ZONDEK-ASCHHEIM reaction in testicular tumours - - - 358

PRINTED IN GREAT BRITAIN BY JOHN WRIGHT AND SONS LTD., BRISTOL

VOL. XXVIII QUARTERLY No. 112

AUG 21 1941
Boston Library

The British Journal of Surgery

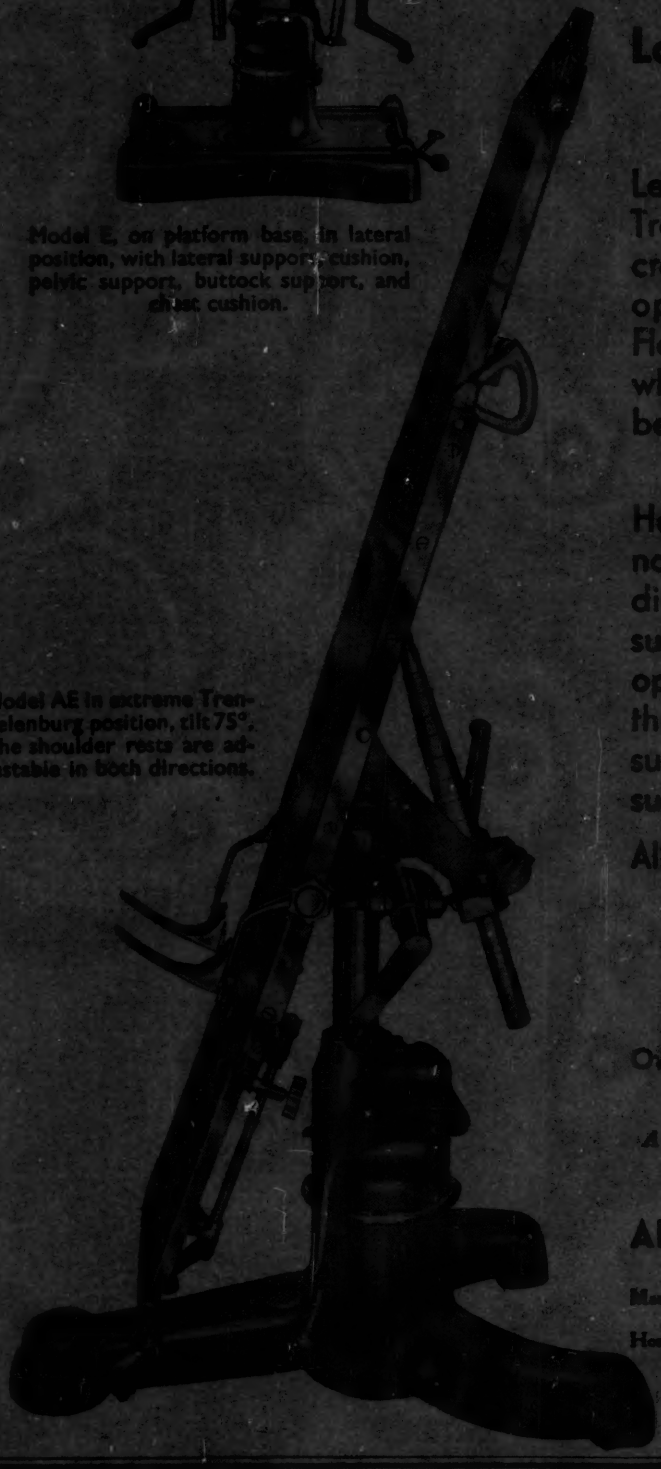
LISTER

APRIL, 1941

BRISTOL: JOHN WRIGHT & SONS LTD.
LONDON: STATIONERS' HALL COURT. SIMPKIN MARSHALL LTD.
UNITED STATES OF AMERICA: THE WILLIAMS & WILKINS COMPANY, BALTIMORE, *Sole Agents.*
Entered as second class matter at the Post Office at BALTIMORE under the Act of March 8, 1879. (Sec. 538 P. L. & R.)

St. Bartholomew's Hospital Operation Table

Model E, on platform base, in lateral position, with lateral support cushion, pelvic support, buttock support, and chest cushion.



Model AE in extreme Trendelenburg position, tilt 75°. The shoulder rests are adjustable in both directions.

Latest Improvements

include

Easy-to-operate Release Lever for lowering the table; Trendelenburg position increased to 75° tilt; Foot-operated rubber-covered Floor Brake, and rubber-tyred wheels fitted with self-oiling bearings.

The St. Bartholomew's Hospital Operation Table is now manufactured in five different models and thus supplies a range of modern operation tables embodying the latest ideas of well-known surgeons for carrying out surgical operations

All models can be supplied with either tripod or platform base.

Prices from £75 + 10%

Over 1200 of these tables are in use at home and abroad.

A descriptive booklet, fully illustrated, will be sent on request.

ALLEN & HANBURYS LTD.

LONDON, E.2

Manufacturers of Surgical Instruments and Appliances, Sterilized Surgical Sutures, Hospital Furniture, and Electro-Medical Apparatus

Showrooms:

42, Wigmore Street, W.1

A NEW *"Emesay" product worthy of note!*

The ROYAL FREE HOSPITAL MULTIPOISE TABLE

An "ALL PURPOSE" general operation table of modern design embodying many new features.

FOUR-SECTION TABLE TOP giving every position required by modern technique.

TRENDELENBURG POSITIONS actuated by one control.

Built-in ADJUSTABLE GOITRE REST.

SPECIAL FITTINGS for Thoracoplasty, Skull and Gynæcological operations.

Heavy "Emesay" quadruped base affords effortless mobility and rigid fixation.

Trendelenburg Position with Third Section Angulated to Relax Abdominal Muscles.

SHOCK RESUSCITATION AFTER AIR RAIDS

APPLIED HEAT A VITAL NECESSITY

Air raid casualties are especially prone to secondary shock. To-day's problem, therefore, is how best to immediately combat loss of body heat when a number of casualties have to be dealt with simultaneously, following intensive aerial attack.

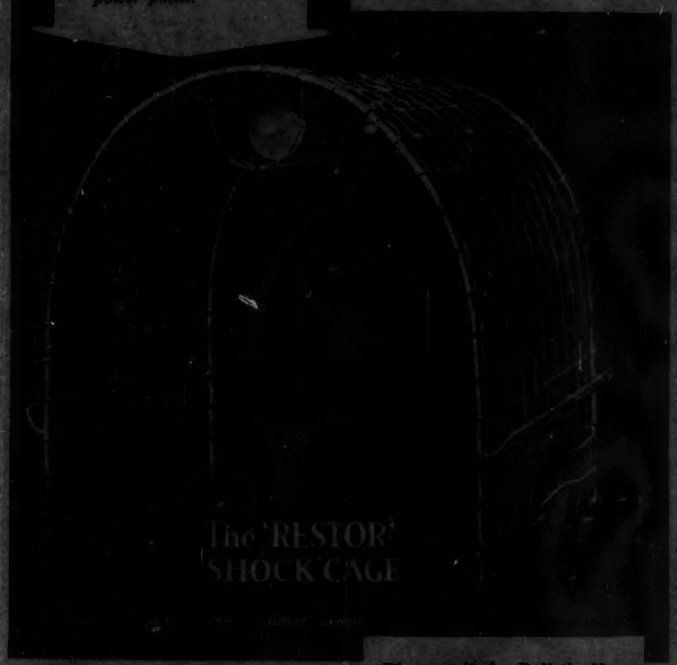
The 'Restor' Shock Cage is the most satisfactory solution as proved by its successful use in the largest hospitals and first-aid stations throughout the United Kingdom. It is the most reliable, economical and hygienic method of using applied heat.

The 'Restor' keeps the patient at a uniform temperature, thermostatically controlled. There is no electrical danger . . . fuses are protected and the cages are 'earthed.' Operated by electrical power a multi-connector makes it possible to run up to thirty cages from one power point.

First cost is small, current consumption light and labour reduced to the turning of a switch.

- ★ *Simply and speedily operated.*
- ★ *Thermostat control ensures safe level temperature.*
- ★ *Easily stored.*
- ★ *Inexpensive and hygienic.*
- ★ *A series of cages may be operated from a single power point.*

We invite you to write for a copy of the new descriptive leaflet dealing with this excellent table, sent free upon application.



Please write for Bulletin No. R.S.C. 840, which fully describes the unique features of the 'Restor' Shock Cage.

THE MEDICAL SUPPLY ASSOCIATION LTD

167-173 Gray's Inn Road, London, W.C.1 and at
Sheffield, Edinburgh, Dublin

INSTRUMENTS FOR

INTRACAPSULAR FRACTURES OF FEMORAL NECK

and

ARTHRODESIS OF THE HIP

DOWN BROS. LTD.

Surgical Instrument Makers

All Correspondence—23 Park Hill Rise, Croydon

LONDON:

SHOWROOMS: 22A CAVENDISH SQUARE, W.1

CALCUTTA:

16 OLD COURT HOUSE STREET

TORONTO:

143 COLLEGE STREET

PRINTED BY JOHN WRIGHT AND SONS LTD., BRISTOL, ENGLAND